# 8.0 Development Phase

## 8.1 List of Validation Studies and Proposals

Following the Checkpoint Presentation, and after rating the ideas, the VE team analyzed several validation studies and prepared several specific proposals.

| Validation No. | Description |
|---|---|
| 1 | I-94/M-10 Interchange Footprint |
| 2 | I-94/I-75 Interchange |
| 3a | I-94 Dequindre Bridge Widening |
| 3b | I-94 Dequindre Bridge and New Adjacent Service Drives |
| 4 | Drainage System |
| 5 | Construction Staging and Scheduling |

| Proposal No. | Description |
|---|---|
| 1 | Review Total Area and Total Cost of Retaining Walls |
| 2 | Use Perimeter Road System for the ServiceDrives for both M-10 and I-75 Interchanges |
| 3 | Shift Location of EB Service Drive at Mt. Elliot to the north |
| 4 | Eliminate Traffic Signals at Certain Intersections |
| 5 | Use 12 ft. median shoulder for I-94 mainline instead of 14 ft. shown |
| 6 | Use 4-ft. median barrier for I-94 mainline instead of six ft. shown |
| 7 | Use valley gutter instead of concrete barrier at outside shoulders of I-94 mainline |
| 8 | Shift the I-94 centerline to the north through the I-75 interchange |
| 9 | Shorten all pedestrian bridges to touchdown between service drives and mainline |
| 10 | Reconfigure E. Grand Avenue with service drive near GM Plant, to reduce or eliminate need for ROW from GM. |
| 11 | Use 2'-4" median barrier for I-94 mainline instead of the six ft. shown, and widen out only at structures |
| 12 | Reduce amount of construction on M-10, south of the interchange |

## 8.2 Summary of Proposals

The following pages contain the validations and proposals studied along with As Designed cost and VE Proposal cost. The results were presented to MDOT on Thursday, March 18, 2004. For the attendance list and copy of the presentation see Appendix C.

## EXISTING CONDITIONS:

The I-94/M-10 interchange is near the west end of the project corridor and provides all movements between the two freeways. The existing interchange has four levels with I-94 crossing over the southbound to eastbound and northbound to westbound ramps. M-10 is the third level, crossing over I-94. The fourth level is the eastbound I-94 to northbound M-10 and westbound I-94 to southbound M-10 ramps. Exhibit V1.1 is an aerial photo looking north at the interchange.

Land development in all four quadrants is either directly adjacent to the freeway right-of-way or along intermittent service drives. The Wayne State University (WSU) athletic fields and parking structures are in the southwest and southeast quadrants, respectively. The McCoy Apartment complex is in the northwest quadrant, separated from the interchange by an open green space. The 4th Street neighborhood, in the northeast quadrant, is very close to the westbound I-94 to northbound M-10 ramp. It is set back slightly by a short length of public street right-of-way. Exhibit V1.2 shows the aerial mosaic mapping that is the base for the DEIS exhibits and work by the VE team.

*Exhibit V1.1*


*Exhibit V1.2*
*Location and photo number (see next page for photos).*

## AS DESIGNED:

The proposed geometrics for the I-94/M-10 interchange were presented in the "Recommended Alternatives Analysis Report" dated August 2002. The proposed design incorporates the "Modification 1" decisions including: 1) I-94 median without reserve space; and 2) two-lane continuous service drives (one lane through M-10 interchange).

Exhibit V1.3 indicates the recommended I-94/M-10 interchange geometrics. Although the Phase I work for the project was started in metric units, the geometry presented in the EPE exhibits for the Recommended Alternatives Analysis Report were developed in U.S. Customary Units. Metric profiles were initially developed but were not yet converted to U.S. Customary Units. The anticipated bridge limits are indicated in orange and green on Exhibit V1.3. The proposed interchange incorporates "continuous" service drives through and around the interchange in each quadrant as shown in grey/blue. The northbound and southbound service drives are grade separated with the eastbound and westbound service drives.

The current design was developed to minimize impacts to the adjoining properties. Minor right-of-way takes are currently proposed from the WSU baseball field in the southwest quadrant, McCoy Apartments green space in the northwest quadrant a portion of 4th Street block in the northeast and the WSU property in the southeast quadrant.

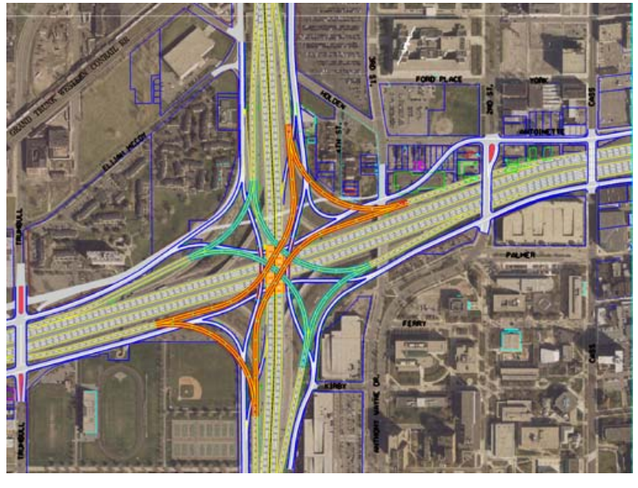


*Exhibit V1.3*


*Exhibit V1.4*
*Looking north along existing service drive from pedestrian bridge south of I-94 at WSU campus.*


*Exhibit V1.5*
*Looking south at WSU baseball field from existing service drive.*


*Exhibit V1.6*
*Looking east at existing cul-de-sac and McCoy Apartment green space.*


*Exhibit V1.7*
*Looking east at a home along 4th Street.*


*Exhibit V1.8*
*Looking north along existing service drive at the Kirby intersection.*


*Exhibit V1.9*
*Looking north along proposed NB service drive at WSU parking structure.*

**GENERAL VALIDATION PROCESS:**

The VE team developed the following general approach to investigate the feasibility of the recommended alternative geometrics:

1. Align aerial mosaic, topographic and ROW files with recommended alternative geometry.

2. Review horizontal alignments:
   - Spot check ramps and service drives (minimum horizontal curves, stopping sight distance, intersection placement, critical clearances).
   - Identify locations with multiple levels, existing vertical constraints and short horizontal distances.
   - Review proposed ramps relative to proposed service drive, and intersection grades.

3. Summarize critical design criteria:
   - Vertical Alignment: Crest K=44 (40 mph); Crest K=19 (30 mph)
   - Stopping sight distance: 40 mph = 305', 30 mph = 200'
   - Grades: 4% desirable, 6% maximum
   - Underclearances: 14'-6" @ edge of shoulder (minimum), 14'-9" @ edge of shoulder (desirable).

4. Recreate all alignments in U.S. Customary Units.

5. Review Phase I metric profiles for I-94, interchange ramps, service drive ramps, and service drives (profiles did not relate to the U.S. Customary Units recommended alternative geometrics which were provided to the VE team).

6. Create U.S. Customary Unit profiles for I-94, M-10, interchange ramps, service drive ramps, and service drives to review vertical geometry and ROW footprint.

7. Estimate bridge construction depths.

8. Calculate bridge underclearances.

9. Modify alignments and profiles as required.

**VALIDATION OF I-94/M-10 INTERCHANGE FOOTPRINT**

**OBJECTIVE:**

The VE team was tasked with investigating if it is feasible for the current I-94/M-10 interchange design to be constructed within the DEIS right-of-way footprint shown on the exhibits developed by the Phase I consultant.

***Project Assumptions:***

The following assumptions were made for the geometric review of the I-94/M-10 interchange:

- The I-94 profile will be held as shown in the DEIS, and a direct conversion to U.S. Customary Units will be made.
- The M-10 profile will be held as shown in the DEIS, and a direct conversion to U.S. Customary Units will be made.
- The horizontal geometric concept of the interchange will be maintained for the initial review.

***Design Criteria:***

The following key criteria were used to check the interchange geometrics.

- 14'-6" minimum vertical clearance for bridges over I-94, M-10, ramps and service drives. The VE team was informed that the requirement of 16'-3" clearance is not required on the freeways in this project.

- Design Speeds
  I-94 and M-10: 60 mph desirable
  Ramps: 40 mph desirable
  Service Drives: 30 mph

- "K" Values
  I-94 & M-10: Crest=151 Sag=136
  Ramps: Crest=44 Sag=64
  Service Drives: Crest=29 Sag=37

- Maximum Grades
  I-94 and M-10: 4% maximum
  Ramps: 4-6% maximum
  Service Drives: 6- 9% maximum

- Superelevation of 6% on all system ramp main curves.

***Horizontal Geometry:***

The first step in reviewing the geometry was to convert the I-94 DEIS metric centerline to U.S. Customary Units. A "local" stationing was established with Station 100+00 starting at the beginning of the metric stationing. The conversion to U.S. Customary Units was considered necessary at this time to develop information from the Recommended Alternative exhibit, which was determined to have been created in U.S. Customary Units. Also, since the cost estimate provided was in U.S. Customary Units, the team decided to make the conversion. An U.S. Customary Units centerline and stationing was also established for M-10.

Each system interchange ramp was assigned a ramp name for ease of reference as follows (see Exhibit V1.10):

Ramp A - NB M-10 to WB I-94
Ramp B - EB I-94 to NB M-10
Ramp C - SB M-10 to EB I-94
Ramp D - WB I-94 to SB M-10
Ramp E - WB I-94 to NB M-10
Ramp F - NB M-10 to EB I-94
Ramp G - EB I-94 to SB M-10
Ramp H - SB M-10 to WB I-94

U.S. Customary Unit horizontal alignments were then developed for the ramps from the graphical "Recommended Alternative" file provided. The U.S. Customary Unit alignments for the eight system interchange ramps (Ramps A-H), established by mathmetizing the exhibit provided, use the minimum radius of 510' for 40 mph. One of the Ramp D curves uses a 526' radius. Since the controlling radii are already at the minimum they cannot be reduced to lessen the impacts of Ramps E and G on the right of way in the NE and SW quadrants, without design exceptions. Also, due to the right of way constraints in all four quadrants of the interchange, the ramp curves cannot be increased to provide more than minimum radii. For all of the system ramp main curves, the superelevation rate of 6 percent is required for the 510' radius. Since there is very little flexibility in the ramp geometry, the VE team decided to hold the alignments developed for use in investigating the profiles.

The VE team did not investigate the ramp gores relative to the use of standard design or in relation to proposed structures. This may affect the layout.

The design speed for the service drives is 30 mph. The minimum radius with a normal crown (2 percent cross slope) is 250 ft. All proposed alignments provide at least the minimum except the WB to NB service drive connection (Ramp E), which has a radius of 150 ft. This radius will provide for 25 mph with a 2.5 percent cross slope.

***Critical Horizontal Clearance Locations:***

The following areas have been identified as the locations that constrain the geometric footprint of the I-94/M-10 interchange:

Ramp G (EB I-94 to SB M-10) encroaches on the existing right of way of the Wayne State baseball field by 10 ft.-15 ft. The topographic mapping does not reflect the current outfield walls that appear to have been constructed recently. Minimizing or eliminating the encroachment was identified as an important desire for the project.

The southbound and westbound service drives, as designed, encroach into the McCoy Apartment green space in the NW quadrant. Some minor additional right-of-way take from the green space may be possible but is not desirable.

The clearance from the NB to EB service drive to the existing parking garage north of Kirby is approximately 12 ft. from the edge of pavement to the building corner. The proposed I-94 right-of-way can be within one foot of the building structure without violating current zoning ordinances. The remaining 11 ft. is adequate for curb and gutter, sidewalk and signing. Since Ramp F adjacent to the northbound to southbound service drive is on structure, the alignment of the service drive could be moved to the west to increase the clearance at the tightest location if necessary.

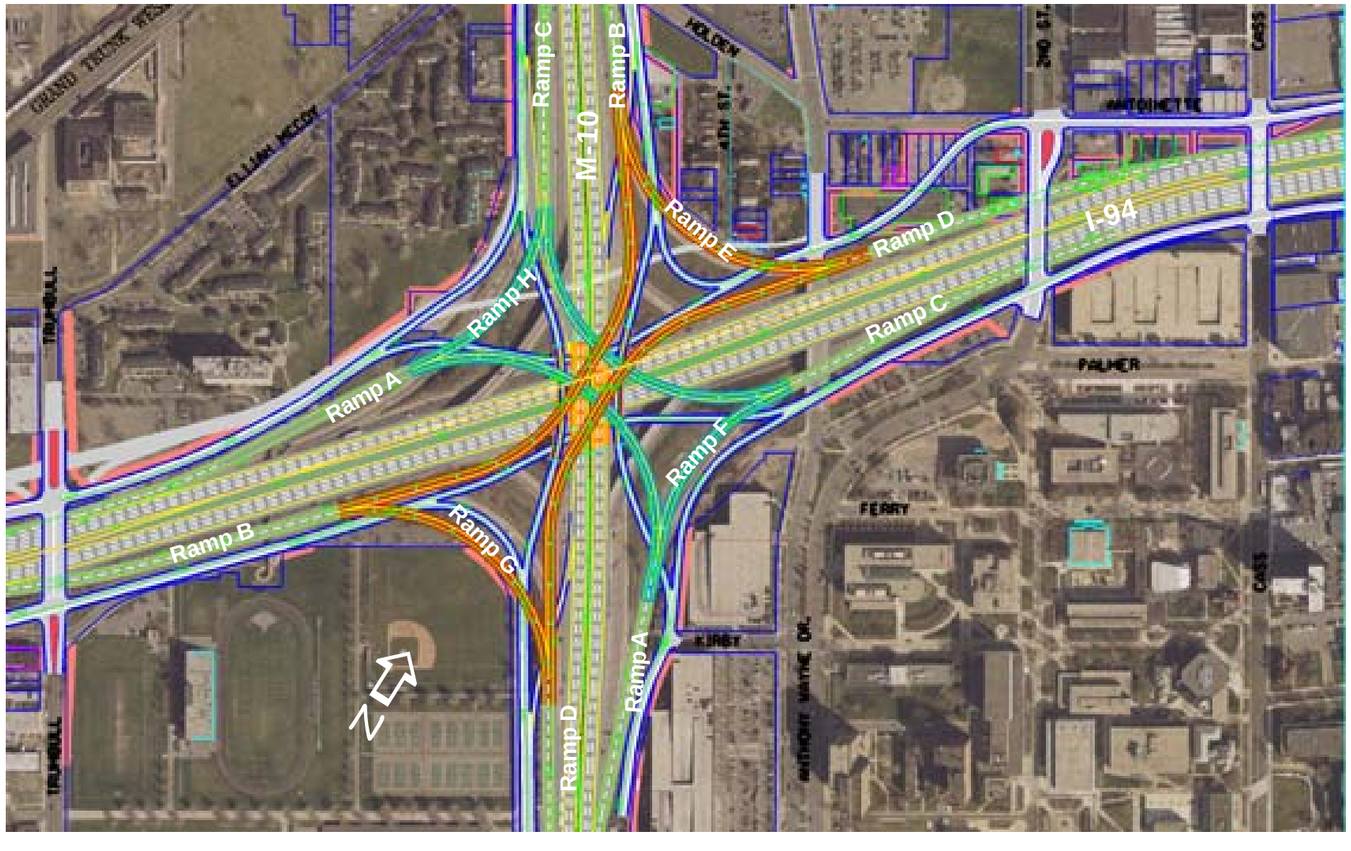



*Exhibit V1.10*
*As Designed alignments with VE ramp names.*

The existing 4th Street neighborhood in the NE quadrant is a critical area. Ramp E (WB I-94 to NB M-10), as designed, comes very close to the south end of existing 4th Street. An existing street right-of-way on the south side of the neighborhood lies between the homes and the proposed Ramp E. Ramp E will be on structure through this area to clear the WB and NB service drives.

***Structures:***

Based on the bridge limits and preliminary substructure locations shown in the Recommended Alternative exhibit, the VE team estimated beam and deck construction depths. The depths were based on 0.04 x span length plus 11 ft. for deck and haunches. This was considered to be conservative for determining the feasibility of the interchange profiles. Span lengths were checked based on DEIS layouts and were very tight with many piers assumed to be single shafts abutting tightly to ramps or roadways.

***Vertical Geometry:***

The VE team converted the metric profiles provided to U.S. Customary Units and attempted to locate them on the U.S. Customary Units alignments. A correlation was not found. The VE team decided to develop new profiles for the ramps to check the feasibility of grades and clearances.

The converted I-94 profile is adequate for a design speed of 60 mph for both sag and crest vertical curves. The crest vertical curves for M-10 will meet the criteria for 60 mph, but the "K" value for the sag curves is slightly less than minimum required for 60 mph, 131.2; which is less than K=136. Revising this value should not adversely impact the ramp geometrics.

All ramp profiles generated meet a design speed of 40 mph for both crest and sag curves. Representative profiles have been included in the report as Exhibits V1.12 - V1.17. The profiles included are I-94, M-10, EB service drive, Ramp A, Ramp B and Ramp D. Several of the ramps have grades in excess of 5% with Ramp A at 5.4%. The grades may need to be steepened further in some locations to provide additional clearances as detailed geometry is developed.

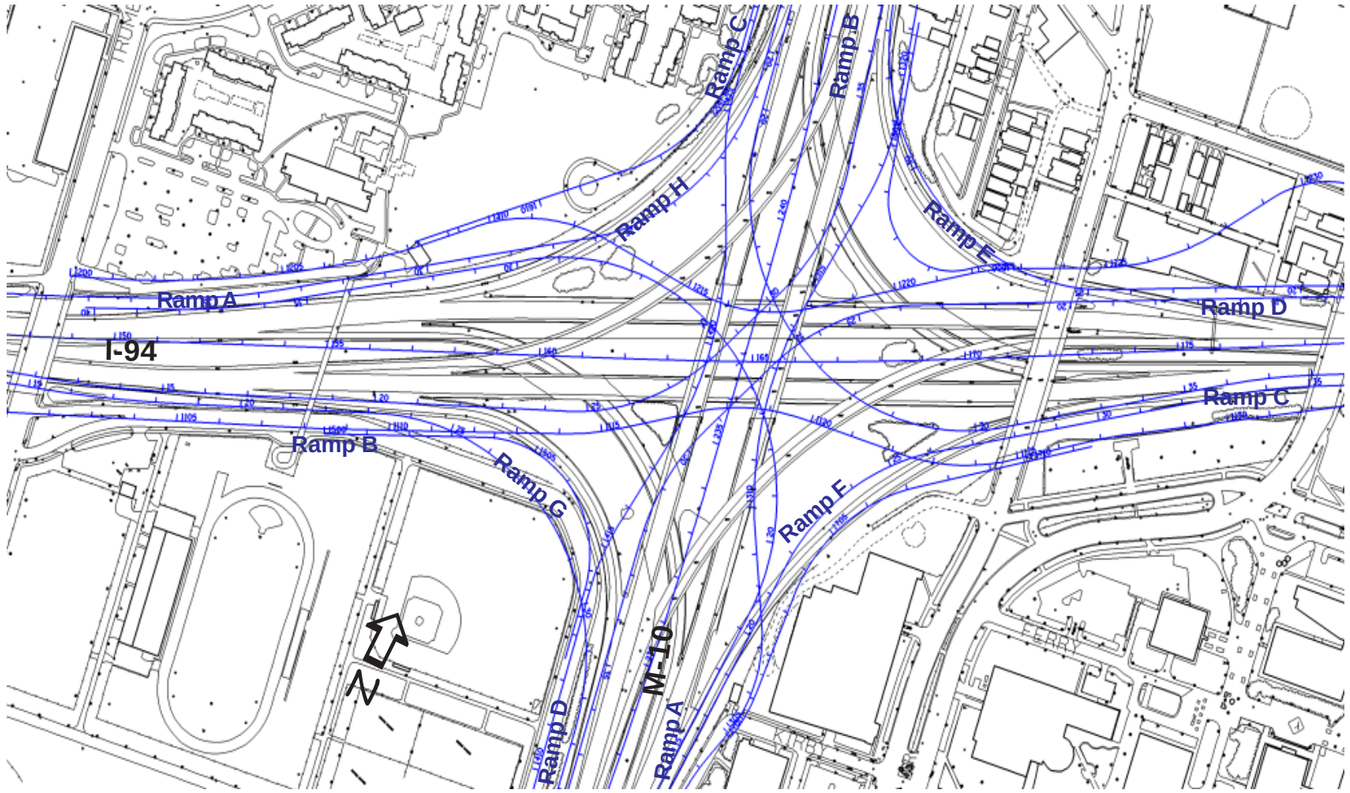



*Exhibit V1.11*
*As Designed alignments.*

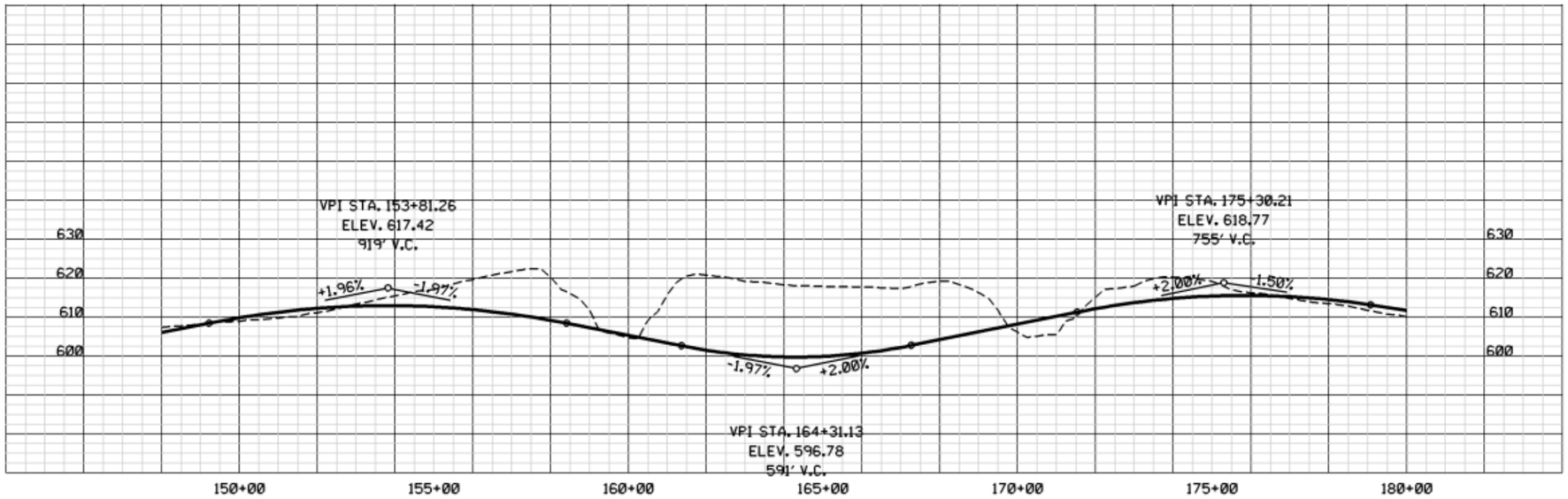



*Exhibit V1.12*
*I-94 As Designed*

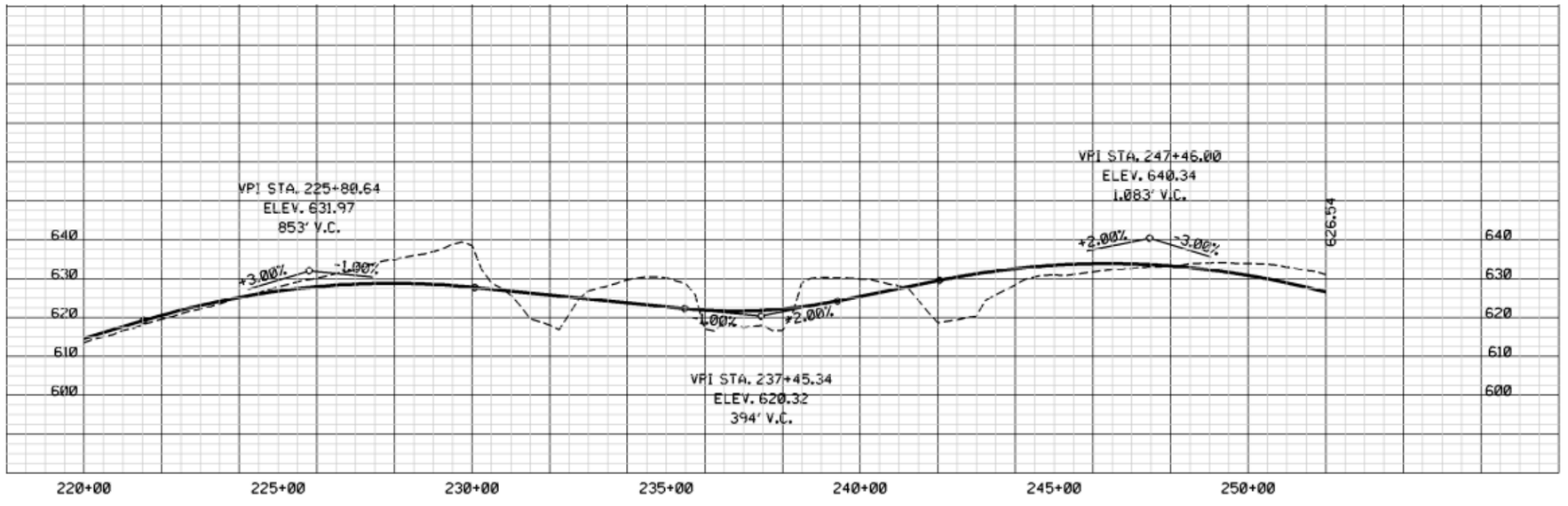



*Exhibit V1.13*
*M-10 As Designed*

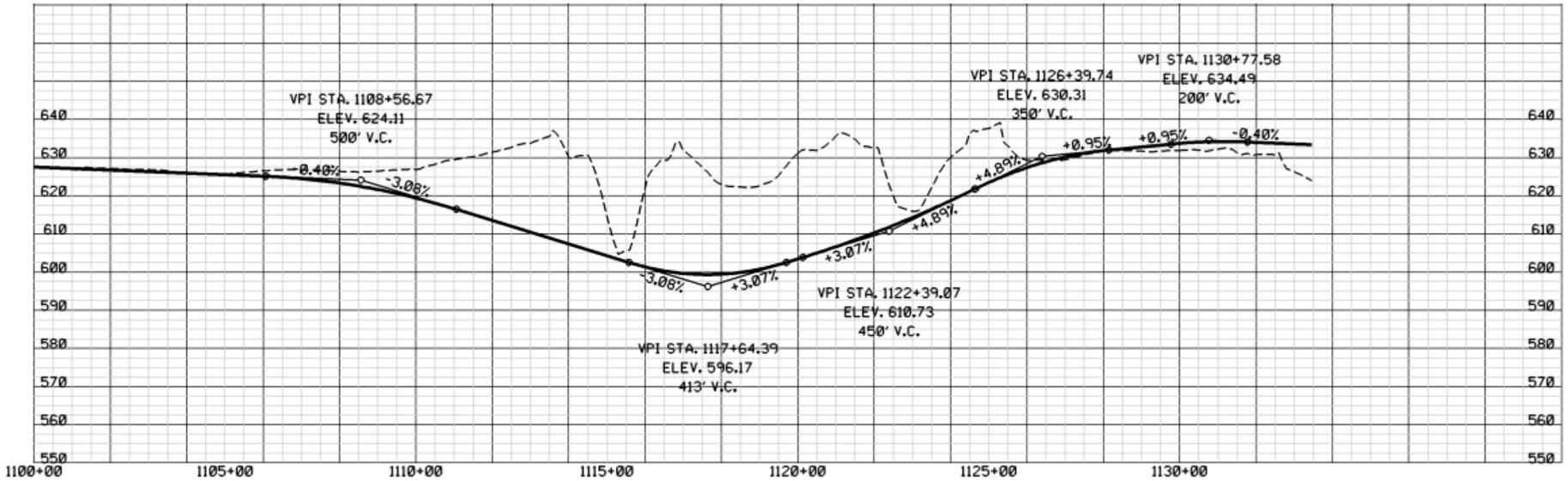



*Exhibit V1.14*
*Eastbound Service Drive VE Proposal*

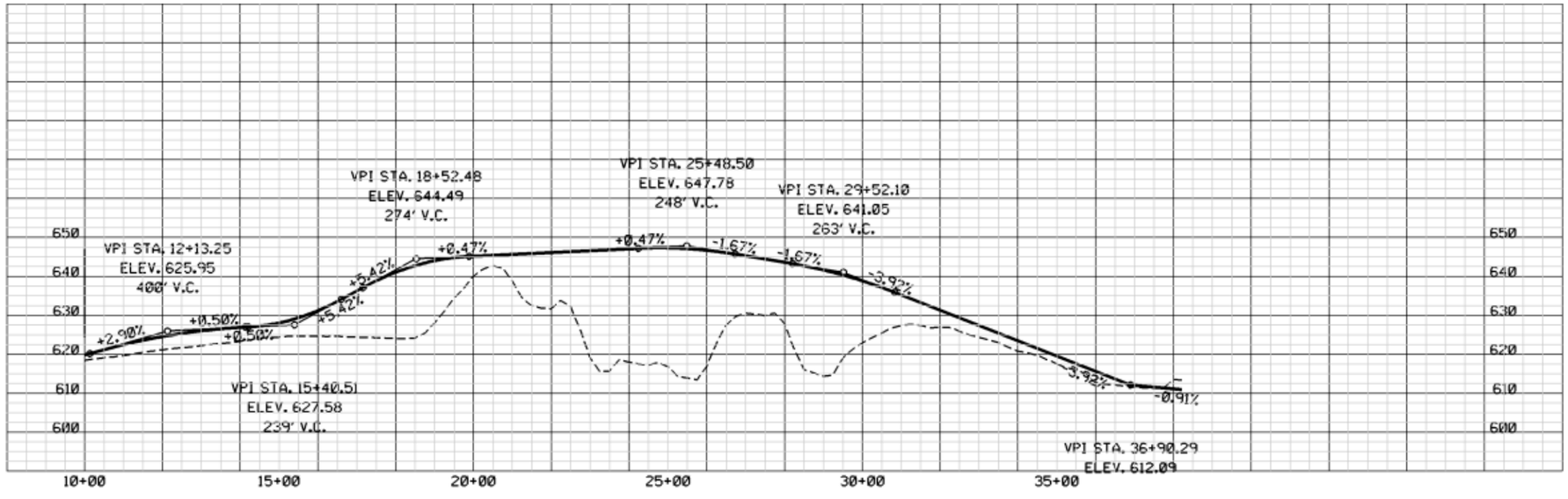



*Exhibit V1.15*
*Ramp A VE Proposal*

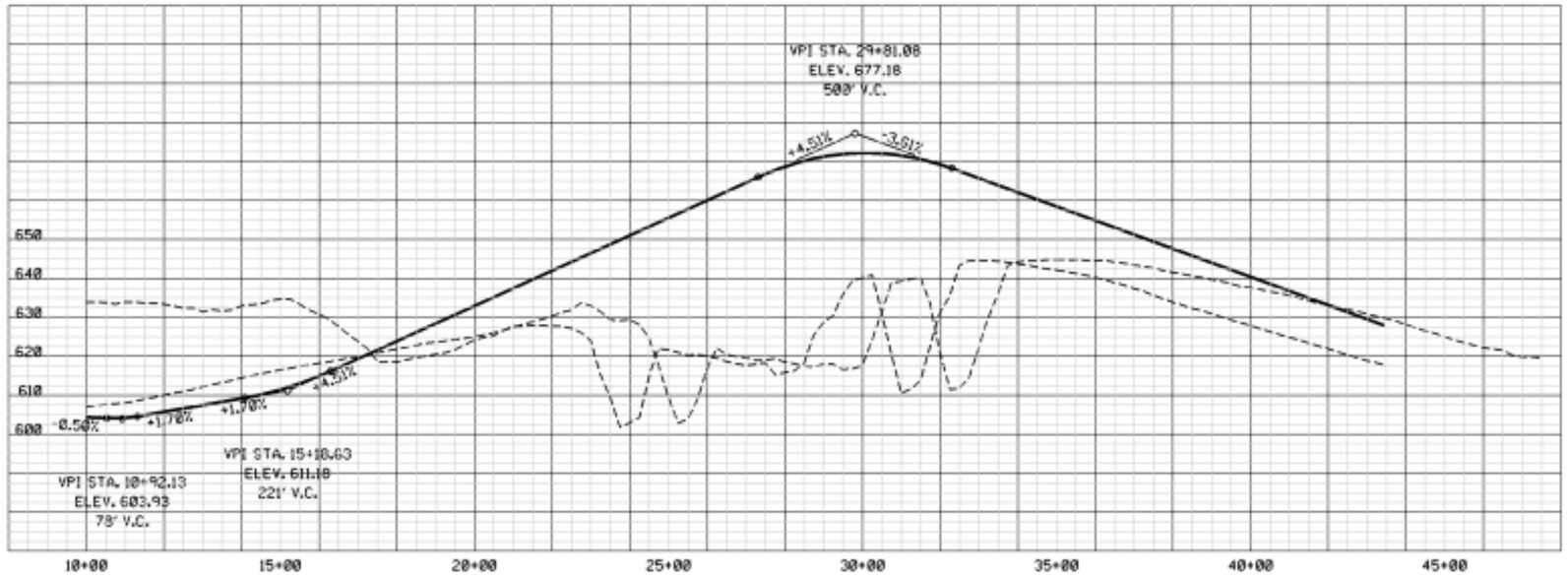



*Exhibit V1.16*
*Ramp B VE Proposal*

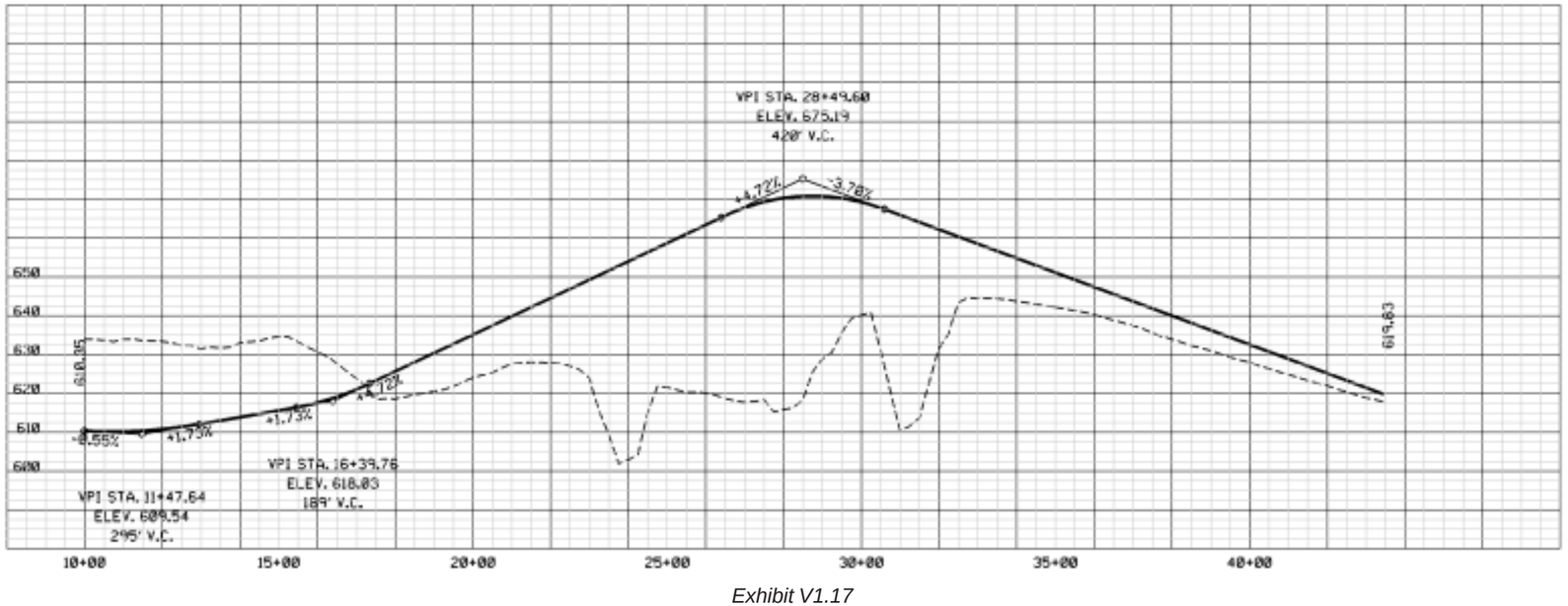



*Exhibit V1.17*
*Ramp D VE Proposal*

***Under Clearances:***

After the horizontal alignments were recreated, station equations for the baseline intersection points were determined. These stations were used to calculate clearances for the profiles developed. Several iterations were made on the critical locations to try to provide at least 16 ft. - 17 ft. between the elevations at the baselines. Because each under clearance location will have unique cross slopes and critical clearance locations, 16.5 ft. +/- was used as a target clearance at the baseline intersections. This location is generally not the point of minimum clearance, where 14'-6" minimum is required. Exhibit V1.18 summarizes the clearance locations, profile grades at the baselines, estimated bridge construction depths of structures and resulting clearances for the interchange geometrics developed. As indicated in the "comments" column, some locations will need further development.

**DESIGN CONSIDERATIONS:**

The following items should be looked at closely in the development of the preliminary geometrics to assure that the features are buildable within the footprint shown in the Recommended Alternative Report, August 2002.

- The design of the ramp profiles must account for the rollover at the ramp gores and the maximum grades for placement of attenuators.
- During refinement of the profiles, 14'-9" desirable, 14'-6" minimum vertical clearances should be provided wherever possible.
- Extensive retaining walls and wingwall extensions will be required between ramps and service drives. Walls will also be required between the service drives and adjacent properties in some locations to allow the service drive profiles to be lowered to provide necessary clearances.

| Roadway Over | Roadway Under | Profile Grade Rdwy Over | Profile Grade Rdwy Under | Elevation Difference | Span Length (ft.) | Bridge Constr. Depth (ft.) | Proposed Clearance (ft.) | Comments |
|---|---|---|---|---|---|---|---|---|
| **M-10 Centerline** | EB Service Rd. | 622.01 | 599.46 | 22.55 | 80 | 4.08 | 18.47 | |
| | I-94 Centerline | 621.64 | 599.79 | 21.85 | 85 | 4.32 | 17.53 | |
| | WB Service Rd. | 622.16 | 601.34 | 20.82 | 80 | 4.08 | 16.74 | |
| | | | | | | | | |
| **NB Service Rd.** | EB Service Rd. | 623.01 | 600.47 | 22.54 | 90 | 4.50 | 18.04 | |
| | I-94 Centerline | 623.90 | 600.32 | 23.58 | 90 | 4.50 | 19.08 | |
| | WB Service Rd. | 622.63 | 601.91 | 20.72 | 90 | 4.50 | 16.22 | |
| | | | | | | | | |
| **SB Service Rd.** | WB Service Rd. | 624.19 | 602.25 | 21.94 | 90 | 4.50 | 17.44 | |
| | I-94 Centerline | 622.99 | 599.76 | 23.23 | 90 | 4.50 | 18.73 | |
| | EB Service Rd. | 622.82 | 599.67 | 23.15 | 90 | 4.50 | 18.65 | |
| | | | | | | | | |
| **Ramp A** | NB Service Rd. (south) | 643.80 | 620.03 | 23.77 | 150 | 6.93 | 16.84 | |
| | NB Service Rd. (north) | 646.49 | 622.88 | 23.61 | 150 | 6.93 | 16.68 | |
| | SB Service Rd. | 647.32 | 623.59 | 23.73 | 150 | 6.93 | 16.80 | |
| | | | | | | | | |
| **Ramp B** | | | | | | | | |
| | Ramp A | 670.48 | 647.28 | 23.20 | 120 | 5.72 | 17.48 | |
| | Ramp C | 672.16 | 644.81 | 27.35 | 120 | 5.72 | 21.63 | |
| **Ramp C** | | | | | | | | |
| | M-10 Centerline | 645.22 | 622.90 | 22.32 | 100 | 4.92 | 17.40 | |
| | NB Service Rd. | 643.97 | 623.31 | 20.66 | 110 | 5.32 | 15.34 | Will require revisions to profiles |
| | | | | | | | | |
| **Ramp D** | Ramp C | 665.87 | 643.53 | 22.34 | 150 | 6.93 | 15.41 | Will require revisions to profiles |
| | Ramp A | 670.20 | 646.81 | 23.39 | 120 | 5.72 | 17.67 | |
| | | | | | | | | |
| **Ramp E** | WB Service Rd. | 638.93 | 616.49 | 22.44 | 130 | 6.12 | 16.32 | May require revisions to profiles |
| | | | | | | | | |
| **Ramp F** | | | | | | | | |
| | EB Service Rd. | 633.43 | 612.22 | 21.21 | 120 | 5.72 | 15.49 | Will require revisions to profiles |
| | | | | | | | | |
| **Ramp G** | EB Service Rd. | 639.79 | 615.12 | 24.67 | 120 | 5.72 | 18.95 | |
| | SB Service Rd. | 652.95 | 626.43 | 26.52 | 130 | 6.12 | 20.40 | |
| | | | | | | | | |
| **Ramp H** | | | | | | | | |
| | SB Service Rd. | 649.07 | 627.45 | 21.62 | 140 | 6.52 | 15.10 | Will require revisions to profiles |
| | WB Service Rd. | 644.20 | 612.08 | 32.12 | 100 | 4.92 | 27.20 | |

Problem values

*Exhibit V1.18*
*Baseline Vertical Clearance Summary by VE team*

- Lowering the I-94 profile east of M-10 may be needed to provide clearance at 2nd Street. Minimizing or eliminating the encroachment was identified as an important desire for the project.

| I-94/M-10 Interchange | Validation 1<br>10 of 10 |
|---|---|

**VALIDATION OBSERVATION:**

The VE Study finds that the indicated I-94/M-10 interchange appears to be buildable as shown, within the footprint indicated on the EPE base map furnished the VE team, based on the 10-day review and analysis of the EPE data we were furnished. The VE team identified that the main curves for all of the system interchange ramps are at the minimum radius for 40 mph design speed. The VE Study also identified that several of the stacked ramp grades as drawn will be greater than 5.5%, but is within the 6% maximum in the AASHTO guidelines. During development of preliminary geometrics, some of the grades may need to be increased to assure necessary clearances and standard ramp gore design. Traffic operations might benefit from moving some gore locations.

A separate "design consideration," Proposal 8, that eliminates a slight "broken back" curve and shifts the I-94 alignment to the north may add some flexibility to the horizontal geometrics, while minimizing the impact to the WSU baseball field. This change would move the WB I-94 to NB M-10 ramp closer to the 4th Street neighborhood and may require purchasing one vacant unbuildable triangular lot. It would also require utilizing additional grassy area at the McCoy housing area.

**EXISTING CONDITIONS:**

The I-94/I-75 interchange is adjacent to the I-94/M-10 interchange near the west end of the project corridor and provides for all of the movements between the two freeways. The existing interchange has three levels with I-94 crossing over the northbound/southbound I-75 freeway and the directional freeway ramps crossing over I-94 and I-75 on the third level to the I-94 and I-75 freeways.

Land development in two of the four quadrants is directly adjacent to the freeway right-of-way, the remaining two quadrants contain presently vacant property without structures. The northeast quadrant contains several vacated buildings (Quality Storage and Service Envelope) in addition to the Kwik Print. The southeast quadrant contains an existing industrial building that is offset from the existing interchange by Hendrie Street and an existing service drive. Both quadrants on the west side of the existing interchange are currently vacant.

Exhibit V2.1 shows an aerial photo of the I-94/I-75 Interchange.

*Exhibit V2.1*

**AS DESIGNED:**

The proposed geometrics for the I-94/I-75 interchange were presented in the Recommended Alternatives Analysis Report dated August 2002 and further refined as part of additional development. The proposed design incorporates the "Modification 1" decisions including 1) median without reserve space; 2) two lane continuous service drives (one lane through interchange); 3) two single lane exit ramps for EB and WB I-94 and 4) I-75 will remain on its existing alignment and will receive no improvements.

Exhibit V2.2 indicates the recommended I-94/I-75 interchange geometrics. Although the Phase 1 work for the project was started in metric units, the geometry presented in the exhibits for the Recommended Alternatives Analysis Report were developed in U.S. Customary Units. Metric profiles were initially developed but were not yet converted to U.S. Customary Units. The proposed interchange incorporates "continuous" and "connected" service drives through and around the interchange, in each quadrant shown in grey/blue.

*Exhibit V2.2*

The current design was significantly compressed to minimize impacts to the adjoining properties. Right-of-way takes are currently proposed for the industrial building in the southeast quadrant and all three buildings in the northeast quadrant. Minor vacant property will be required in the northwest quadrant to accommodate the south to west I-94 directional ramp and associated southbound service drive.

**VALIDATION PROCESS:**

The VE team developed the following general approach to investigate the feasibility of the recommended alternative geometrics for the I-94/I-75 interchange:

1. Reviewed all electronic files provided by MDOT.

2. Recreated all alignments in U.S. Customary Units using the alignments provided the VE team by MDOT at the VE kickoff meeting. The baselines were created utilizing the electronic file "Mod1revised."

4. Reviewed the metric profiles that were created for the I-94, interchange ramps, service drive ramps and service drive (the profiles provided the VE team did not relate to the provided U.S. Customary Units recommended alternative since they were developed using the metric Modification 1 alternative with the wider median as presented in the DEIS).

5. Created U.S. Customary Units profiles for the interchange ramps, service drive ramps and service drives to review vertical geometry and ROW footprint. Exhibits V2.3 and V2.4 display the East to North (E2N) and West to North (W2N) ramps respectively.

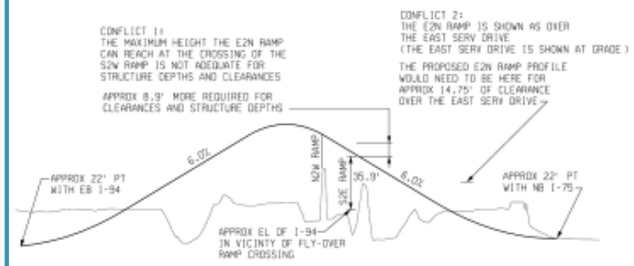



*Exhibit V2.3*

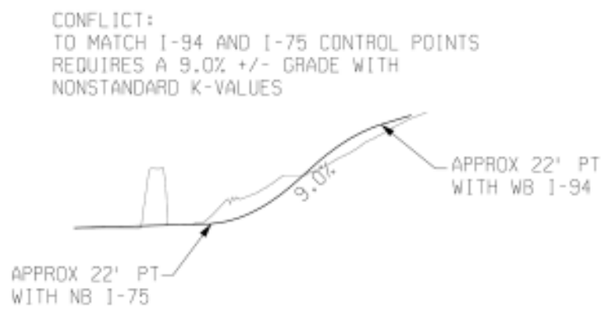



*Exhibit V2.4*

Exhibit V2.5 shows the relationship between the original DEIS Modification 1 alternative with a wide median (yellow) and the U.S. Customary Units Modification 1 alternative, eliminating the wide median and providing a continuous service drive through the interchange (blue).


*Exhibit V2.5*

Shortening the length of the ramps as required in the U.S. Customary Units Modification 1 alternative and adding additional grade separated crossings of the service drive, greatly reduces the distances required for ramps to gain or drop in elevation. These changes require the ramps to maintain significant steep grades, substandard vertical curves, minimized stopping sight distances, and impacting the minimum required bridge under-clearances through the interchange.

6. Review horizontal alignments:
- Spot-checked ramps and service drives (minimum horizontal curves, stopping sight distance, intersection placement, critical clearances).
- Identified locations with multiple levels, existing vertical constraints and short horizontal distances.
- Reviewed proposed ramps relative to proposed service drive, and intersection grades.

7. Summarized Critical Design Criteria:

- Vertical Alignment Crest K= 44(40mph); Crest K=19(30mph).
- Stopping sight distance (40mph=305'; 30mph=200').
- Grades (4% desirable; 6% maximum).
- Underclearances (14'-6" @ edge of shoulder (min); 14'-9" @ edge of shoulder (desirable).

8. Reviewed bridge underclearances. During the development of the U.S. Customary Units profiles for the Modification 1 alternative, it was displayed that obtaining minimum bridge underclearances would not be possible with the alignments provided.

9. Modified ramp and service drive alignments and profiles as required to develop an interchange and local road system that met the design criteria, minimized impacts, and was "continuous."

**VALIDATION OF I-94/I-75 INTERCHANGE OBJECTIVE FOOTPRINT:**

The VE team was tasked with investigating if it is feasible for the current interchange design to be constructed within the DEIS right-of-way footprint shown on the exhibits developed by the Phase I consultant.

**Project Assumptions:**

The following assumptions are the basis for the geometric reviews:

- The I-94 profile will be held as shown in the DEIS and the Dequindre structure will not be reconstructed only widened with allocation for minor grade changes. Therefore, allowing the VE team to assume that there will be no changes to the I-94 vertical profile.
- No improvements will be performed on I-75 therefore the alignment and profile will match existing.
- The horizontal geometric concept will be maintained.

**DESIGN CRITERIA:**

The following key criteria were used to investigate the feasibility of the interchange geometrics.

- 14'-6" minimum vertical clearances for bridges over I-94, I-75, ramps and services drives. The VE team was informed that the requirement of 16'-3" clearances is not required on the freeways in this project.

- Design Speeds

| | |
|---|---|
| I-94 and I-75: | 60mph (desirable) |
| Ramps: | 40mph (desirable) |
| Service Drives: | 30mph (minimum) |

- "K" Values

| | | |
|---|---|---|
| I-94 and I-75: | Crest=151 | Sag=136 |
| Ramps: | Crest=41 | Sag=64 |
| Service Drives: | Crest=29 | Sag=37 |

- Maximum Grades

| | |
|---|---|
| I-94 and I-75: | 4% max. |
| Ramps: | 4-6% max. |
| Service Ramps: | 6-9% max. |

- Superelevation of 6% on all ramp main curves.

**Horizontal Geometry:**

Create I-94, I-75, and directional ramps presented in the recommended alternative Modification 1 centerlines. Establish a "local" stationing for the alignments that would allow a comparison to the metric stationing detailed on the DEIS Modification 1 alternative. This was considered necessary at this time to develop a relationship for the profiles provided to assist in the comparison of the DEIS alternative and the Recommended Alternative exhibit, which was determined to be U.S. Customary Units. Establishing an U.S. Customary Units baseline would also assist in the future evaluation and refinement of the cost estimate. Each ramp was assigned a ramp name for ease of reference.

The following locations have been identified as the locations that constrain the geometric footprint of the I-94/I-75 interchange.

**Horizontal Alignment:**

**Ramps**

The U.S. Customary Units alignments for the system interchange ramps, established by recreating the alignments from the files provided, use radii varying from 766 ft. (50mph) to three substandard ramps; the Northbound I-75 to Eastbound I-94 (N2E) ramp, Southbound I-75 to Eastbound I-94 (S2E) and Westbound I-94 to Northbound I-75 (W2N) which use a 460 ft. (35mph) radius. These ramps will require a design exception for the design speed. Since several of the outer directional ramp radii are already at the minimum they cannot be reduced to avoid impacts to the existing buildings in the northeast and southeast quadrants. In addition, review of the vertical profiles would actually encourage these ramp curves to be flatter to provide longer ramps to improve the vertical alignments. For all of the system ramp main curves, a superelevation rate of six percent is required.

**Service Drives**

The proposed service drives are continuous through the interchange, with several entrance and exit ramps from the freeways to the service drive within the interchange.

The design speed for the service drives is 30mph. The minimum radius with a normal crown (2 percent cross slope) is 250 feet. There are several radii for the northbound and southbound service drive sections terminating into the eastbound/westbound service drive where the radii are detailed to be less than 250 feet and require superelevation.

**Structures:**

Estimate bridge beam and deck construction depths from the preliminary spans indicated on the geometry file. Review Recommended Alternatives pier and abutment locations.

**Vertical Geometry:**

***Profile Review:***

The profile sheets for the converted U.S. Customary Units vertical curves were reviewed and the following summarizes the findings:

***I-94***

It was assumed that the profile for this alignment will match the existing conditions. The existing profile is adequate for a design speed of 60mph for both sag and crest vertical curves.

***I-75***

This vertical alignment was not analyzed, since this road will not be part of the interchange reconstruction. Independent shots of the existing freeway were used to tie the proposed ramps down.

***Ramps:***

To accommodate the continuous service drives through the interchange, several of the ramps will require grades in excess of 6%, require design speeds less than 25 mph, and violate the minimum underclearances. Each of the ramps and associated service drives that do not meet the design criteria and can not be upgraded without a significant change to the vertical alignment are detailed as dashed red lines on Exhibit V2.6

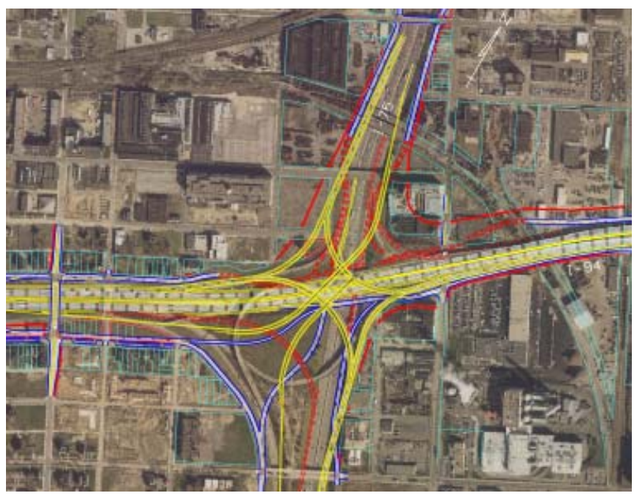


*Exhibit V2.6*

To validate the interchange therefore, would require redesign of the horizontal and vertical alignments of the service drives and ramps to ensure that any proposed enhancements would fit within the DEIS footprint.

**Revised I-94/I-75 Interchange Configuration:**

Reviewing the ramps and service drive alignments that were eliminated due to conflicts or substandard geometry, it was determined to eliminate the westbound service drive through the interchange and provide a continuous service drive on the north side of the interchange by moving the northbound and southbound service drives outside of the ramps and create a u-turn crossing at Milwaukee Street. Another u-turn crossing will be required at Russell and Beaubien Streets to accommodate the eastbound to westbound service drive movements. Moving the service drive outside of the interchange on the north side would eliminate several ramp vertical constraints, thereby improving the grades and design speeds. The proposed service drive and ramp improvements are detailed in Exhibit V2.7


*Exhibit V2.7*

Eliminating the two single lane exit ramps for both the eastbound and westbound I-94 ramps to I-75 and combining them into a two lane exit ramp, eliminates the need to cross the Eastbound to Northbound ramp over the Eastbound to Southbound ramp and cross the Westbound to Southbound ramp over the Westbound to Northbound ramp, thereby improving the grades, design speed and consistency of interchange design to the northbound and southbound I-75 exit ramps to match driver expectancy.

All of the I-94 and I-75 service drive exit ramps would still be able to be accommodated with the revised design.

**VALIDATION OBSERVATION:**

The VE Study finds that the indicated I-75/I-94 interchange does not appear to be buildable as shown on the EPE base map furnished the VE team, within the footprint indicated, based on the 10-day review and analysis of the EPE data we were furnished. The VE Study identified that one or more Continuous Service Roads pose serious conflicts with structures and grades for the mainlines and multiple stacked interchange ramps. In addition, the single lane WB I-94 to NB I-75 and EB I-94 to SB I-75 exit ramps also pose serious conflict with structures and grades for the other flyover ramps. The VE Study identified two possible solutions that move the WB I-94, NB and SB I-75 Service Road and the WB to NB and SB to WB ramps outside of the EPE footprint. One additional vacant property in the NW quadrant will be required to complete this change.

## EXISTING CONDITION:

The existing bridge is a 29-span structure that was reconstructed in 1999 and 2000. The bridge accommodates a minimum of three lanes in each direction on the mainline, in addition to ramp lanes. There is a 1" open joint between the eastbound and the westbound bridge decks. The median shoulders are four-foot-wide.

## AS DESIGNED:

The current design proposes to widen the westbound deck to accommodate the proposed west-to-south and west-to-north I-94 off-ramps. The current design also realigns eastbound and westbound I-94, thereby relocating the proposed median barrier approximately 12 ft. to the north of its current location. The existing bridge deck would therefore need to be widened to the north and reconstructed at the existing barrier location. The four foot median shoulders are maintained.

| Description | Area (Sq. ft.) | Unit Cost | Cost |
|---|---|---|---|
| Remove portion of bridge over Russell | 43,000 | $20 | $860,000 |
| Rebuild portion of bridge over Russell | 43,000 | $100 | $4,300,000 |
| Widen Dequindre deck w/4' shoulders | 59,762 | $135 | $8,067,870 |
| Remove/replace existing shoulder | 28,800 | $35 | $1,008,000 |
| | | | $14,200,000 |

## VE PROPOSAL:

***Option 1:***

VE Option 1 proposes to remove and replace the entire existing westbound deck. The four foot median shoulders are maintained.

The cost to remove and replace the entire WB deck would be approximately $18.7 million.

| Description | Area (Sq. ft.) | Unit Cost | Cost |
|---|---|---|---|
| Remove portion of bridge over Russell | 43,000 | $20 | $860,000 |
| Rebuild portion of bridge over Russell | 43,000 | $100 | $4,300,000 |
| Widen Dequindre deck w/4' shoulders | 59,762 | $135 | $8,067,870 |
| Redeck WB Dequindre bridge | 157,804 | $35 | $5,523,140 |
| | | | $18,700,000 |

***Advantages:***

- New westbound deck provides longer life
- Reduces longitudinal construction joints
- Eliminates maintenance issues associated with deck widening on westbound (construction joints between existing and proposed deck)
- Westbound deck can be used for maintenance of traffic (MOT) when the existing eastbound deck eventually needs to be rehabilitated

***Disadvantages:***

- Additional construction cost
- Still have longitudinal construction joint on eastbound in driving lane
- I-94 Alignment will need to be shifted approximately 10 ft. to the north along bridge length
- Substandard four foot median shoulders remain

***Preliminary Additional Construction Cost Estimate:***

VE Option 1 costs approximately $4,500,000 more than the As Designed Option.

***Option 2:***

VE Option 2 proposes to remove and replace the entire existing westbound deck and provide 14 ft. median shoulders on eastbound and westbound I-94.


*Exhibit V3a.1*
*Westbound Dequindre Deck Replacement*

The cost to remove and replace the entire westbound deck and to provide 14 ft. inside shoulders would be approximately $25.2 million.

| Description | Area (Sq. ft.) | Unit Cost | Cost |
|---|---|---|---|
| Remove portion of bridge over Russell | 43,000 | $20 | $860,000 |
| Rebuild portion of bridge over Russell | 43,000 | $100 | $4,300,000 |
| Widen Dequindre deck w/14' shldrs. | 107,762 | $135 | $14,547,870 |
| Redeck WB Dequindre bridge | 157,804 | $ 35 | $5,523,140 |
| | | | $25,200,000 |

## I-94 Dequindre Bridge Widening



***Advantages:***

- Standard 14 ft. median shoulders are provided on eastbound and westbound I-94
- Additional capacity on eastbound and westbound I-94 for future MOT
- New westbound deck has longer life
- Reduces longitudinal construction joints.
- Eliminates maintenance issues associated with deck widening on westbound (construction joints between existing and proposed deck).
- Westbound deck can be used for MOT when the existing eastbound deck eventually needs to be rehabilitated.

***Disadvantages:***

- Additional construction cost.
- Still have longitudinal construction joint on eastbound in driving lane.
- I-94 alignment will need to be shifted approximately 10 ft. to the north along bridge length.
- Westbound ramps that tie into the north side of the structure need to be shifted 20 ft. to the north.

***Preliminary Additional Construction Cost Estimate:***

VE Option 2 costs approximately $11,000,000 more than the As Designed Option.

***Option 3:***

VE Option 3 proposes to remove and replace the entire existing Dequindre Bridge deck. The four foot median shoulders are maintained.

The cost to remove and replace the Dequindre Bridge deck would be approximately $24.2 million.

| Description | Area (Sq. ft.) | Unit Cost | Cost |
|---|---|---|---|
| Remove portion of bridge over Russell | 43,000 | $20 | $860,000 |
| Rebuild portion of bridge over Russell | 43,000 | $100 | $4,300,000 |
| Widen Dequindre deck w/4' shoulders | 59,762 | $135 | $8,067,870 |
| Redeck all Dequindre bridge | 315,608 | $35 | $11,046,280 |
| | | | $24,200,000 |

***Advantages:***

- Provides flexibility for new mainline geometry, since it would not be limited to tie exactly into existing deck (width and height can be slightly adjusted).
- New deck has longer life.
- Reduces longitudinal construction joints on eastbound and westbound decks.
- Eliminates maintenance issues associated with deck widening (construction joints between existing and proposed).

***Disadvantages:***

- Additional construction cost.
- Still have longitudinal construction joint on eastbound in driving lane.
- I-94 alignment will need to be shifted approximately 10 ft. to the north along bridge length.
- Substandard 4 ft. shoulders remain.

***Preliminary Additional Construction Cost Estimate:***

VE Option 3 costs approximately $10,000,000 more than the As Designed Option.

***Option 4:***

VE Option 4 proposes to replace the entire Dequindre Bridge deck, and provide 14 ft. median shoulders on eastbound and westbound I-94.

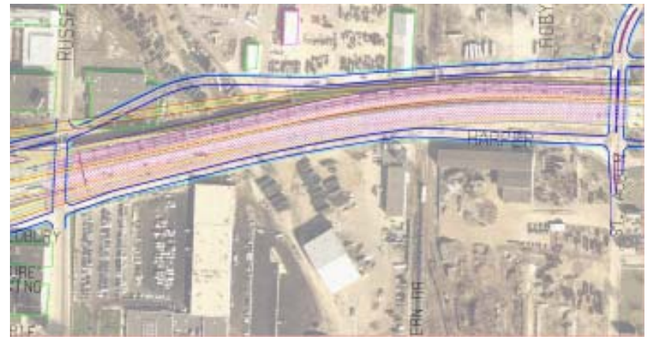


*Exhibit V3a.2*
*Complete Dequindre Deck Replacement*

The cost to remove and replace the Dequindre Bridge deck and to provide 14 ft. median shoulders would be approximately $30.7 million.

| Description | Area (Sq. ft.) | Unit Cost | Cost |
|---|---|---|---|
| Remove portion of bridge over Russell | 43,000 | $20 | $860,000 |
| Rebuild portion of bridge over Russell | 43,000 | $100 | $4,300,000 |
| Widen Dequindre deck w/14' shldrs. | 107,762 | $135 | $14,547,870 |
| Redeck all Dequindre bridge | 315,608 | $35 | $11,046,280 |
| | | | $30,700,000 |

***Advantages:***

- Standard 14 ft. median shoulders are provided on eastbound and westbound I-94.
- Provides flexibility for new mainline geometry, since it would not be limited to tie exactly into existing deck (width and height can be slightly adjusted).
- Additional capacity on eastbound and westbound I-94 for future MOT.
- New deck has longer life.
- Eliminates longitudinal construction joints on eastbound and westbound decks.

- Eliminates maintenance issues associated with deck widening (construction joints between existing and proposed deck).

***Disadvantages:***

- Additional construction cost.
- I-94 alignment will need to be shifted approximately 10' to the north along bridge length.
- Westbound ramps that tie into the north side of the structure need to be shifted 20 ft. to the north.

***Preliminary Additional Construction Cost Estimate:***

VE Option 4 costs approximately $16,500,000 more than the As Designed Option.

***Option 5:***

VE Option 5 proposes to fill the Dequindre Bridge area and to provide new structures at Russell, St. Aubin, Waste Management/DPW and the railroad. The I-94 cross section would provide 14 ft. median shoulders.


*Exhibit V3a.3*
*Four Structures (with fill) Option 5*

Due to the poor soils in the bridge area, the fill would be lightweight EPS foam block (or similar) to avoid settlement problems. VE Option 5 also assumed the fill would be walled on both sides due to ROW and adjacent service drives.

The cost of removing the existing structure, building four new structures and filling the areas in between would be approximately $37.7 million.

| Description | Area (Sq. ft.) | Unit Cost | Cost |
|---|---|---|---|
| Remove existing Dequindre | 359,830 | $20 | $7,196,600 |
| I-94 over Russell* | 14,000 | $145 | $2,030,000 |
| I-94 over railroad* | 15,300 | $145 | $2,218,500 |
| I-94 over St. Aubin* | 15,300 | $145 | $2,218,500 |
| I-94 over Waste Mgmt./DPW** | 27,600 | $145 | $4,002,000 |
| Fill volume | 5,746,000 | $3.50 | $20,111,000 |
| | | | $37,700,000 |

* 90 ft. single span full height abutments.
** 160 ft. single span full height abutments.

***Advantages:***

- Less bridge to maintain in future.
- New decks and pavement have longer life.
- Eliminates maintenance issues associated with deck widening (construction joints between existing and proposed deck).
- Standard 14 ft. median shoulders are provided on eastbound and westbound I-94.
- Provides flexibility for new geometry, since it would not be limited to tie exactly into existing deck (width and height can be slightly adjusted).
- Additional capacity on eastbound and westbound I-94 for future MOT.

***Disadvantages:***

- Additional construction cost.
- Restricts north/south movements to Russell, St. Aubin, Waste Management/DPW and the railroad.
- I-94 alignment will need to be shifted approximately 10 ft. to the north through bridge, and westbound ramps that tie into the north side of the structure need to be shifted 20 ft. to the north.
- Additional work in contaminated soils.

***Preliminary Additional Construction Cost Estimate:***

VE Option 5 costs approximately $23,500,000 more than the As Designed Option.

***Option 6:***

VE Option 6 proposes to replace the entire existing Dequindre Bridge superstructure, including the provision for 14 ft. median shoulders.


*Exhibit V3a.4*
*Complete Dequindre Superstructure Replacement*

The cost of removing the existing superstructure, widening the substructure and replacing the superstructure would be approximately $41.9 million.

## I-94 Dequindre Bridge Widening



| Description | Area (Sq. ft.) | Unit Cost | Cost |
|---|---|---|---|
| Remove existing superstructure | 341,608 | $10 | $3,416,080 |
| Widen Dequindre deck w/14' shldrs. | 107,762 | $135 | $14,547,870 |
| Replace superstructure | 341,608 | $70 | $23,912,560 |
| | | | $41,900,000 |

***Advantages:***

- Standard 14 ft. median shoulders are provided on eastbound and westbound I-94.
- Longer superstructure life.
- Additional capacity on eastbound and westbound I-94 for future MOT.
- Reduced future user cost.
- Reduced future maintenance cost.
- Unconstrained with existing bridge alignment, profile and superelevation (with minor pier cap work).
- Eliminates maintenance issues associated with deck widening (construction joints between existing and proposed deck).
- Can better adjust existing deck grades to meet new ramp profiles.

***Disadvantages:***

- Additional construction cost.
- I-94 Alignment will need to be shifted approximately 10 ft. to the north through bridge, and westbound ramps that tie into the north side of the structure need to be shifted 20 ft. to the north.
- Additional work in contaminated soil.

***Preliminary Additional Construction Cost Estimate:***

VE Option 6 costs approximately $27,700,000 more than the As Designed Option.

***Option 7:***

VE Option 7 proposes to replace the entire existing Dequindre Bridge, including the provision for 14 ft. median shoulders.

The cost of removing and replacing the entire existing structure would be approximately $53.8 million.

| Description | Area (Sq. ft.) | Unit Cost | Cost |
|---|---|---|---|
| Remove existing Dequindre | 359,830 | $20 | $7,196,600 |
| Rebuild entire bridge | 466,370 | $100 | $46,637,000 |
| | | | $53,800,000 |

***Advantages:***

- Standard 14 ft. median shoulders are provided on eastbound and westbound I-94.
- Additional capacity on eastbound and westbound I-96 for future MOT.
- Longest structure life.
- Reduced future user cost.
- Reduced future maintenance cost.
- Completely unconstrained with the existing bridge alignment, profile and superelevation.
- Eliminates maintenance issues associated with deck widening (construction joints between existing and proposed deck).

***Disadvantages:***

- Additional construction cost.
- I-94 Alignment will need to be shifted approximately 10 ft. to the north through bridge, and westbound ramps that tie into the north side of the structure need to be shifted 20 ft. to the north.
- Additional work in contaminated soils.

***Preliminary Additional Construction Cost Estimate:***

VE Option 7 costs approximately $39,600,000 more than the As Designed Option.

**RECOMMENDATION:**

It is recommended that VE Option 4 be implemented. For this option, the entire deck for eastbound and westbound I-94 would be replaced and widened. The advantages for this option are as follows:

- Standard 14 ft. median shoulders are provided on eastbound and westbound I-94.
- Provides flexibility for new mainline geometry, since it would not be limited to tie exactly into existing deck (width and height can be slightly adjusted).
- Additional capacity on eastbound and westbound I-94 for future MOT.
- New deck has longer life.
- Eliminates longitudinal construction joints on eastbound and westbound decks.
- Eliminates maintenance issues associated with deck widening (construction joints between existing and proposed deck).

This option costs approximately $16,500,000 more than the As Designed, or approximately $30,700,000 total.

It is also suggested that VE Option 6 (the superstructure replacement option) be considered, should reserve funds become available. In addition to extended superstrucuture life, VE Option 6 provides flexibility of using a modified vertical alignment for the mainline and the proposed exit ramps on the north bridge fascia.

Table V3a.1 summarizes the cost results of Validation 3a. Table V3a.2 provides the details of the cost estimates. The minimum cost is $14,200,000 for the As Designed solution. The Primary VE Recommendation, VE Option 4, requires the addition of a contingency (C) of $16,500,000 to the minimum cost in order to define the Expected Cost.

The Secondary VE Recommendation, VE Option 6, requires the addition of a reserve (R) of $11,200,000 ($27,700,00 - $16,500,000) to the Expected Cost in order to define the maximum cost.

| Item | As Designed Cost | VE Proposal Cost | Cost Difference | Cost Category |
|---|---|---|---|---|
| As Designed | $14,200,000 | - | - | Min. Cost |
| Option 1 | | $18,700,000 | ($4,500,000) | - |
| Option 2 | | $25,200,000 | ($11,000,000) | - |
| Option 3 | | $24,200,000 | ($10,000,000) | - |
| Option 4 | | **$30,700,000** | **($16,500,000)** | **C** |
| Option 5 | | $37,700,000 | ($23,500,000) | - |
| Option 6 | | **$41,900,000** | ***($27,700,000)*** | ***R*** |
| Option 7 | | $53,800,000 | ($39,600,000) | - |

*Table V3a.1*

## VALIDATION OBSERVATION:

The VE Study finds that the I-94 work appears to be buildable as shown on the EPE base map furnished to the VE team, within the footprint indicated, based on the 10-day review and analysis of the EPE data we were furnished. The VE Study also identified that the DEIS Cost Estimate contains $14.2 million for unspecified work to this large bridge whose decks were rebuilt in 1999, and that alternatives exist to the indicated WB deck widening that might be more economical in the long term if the deck(s) were fully replaced rather than introduce a new construction joint line(s) as proposed in the EPE base map.

**Validation 3a- Dequindre Bridge Widening**

**Cost Analysis for VE Recommendations**

| | Area (Sq.ft.) | Unit Cost | Cost | Comments |
|---|---|---|---|---|
| **Currently Proposed Work** | | | | |
| Remove Portion of Bridge over Russell | 43,000 | $20 | $860,000 | |
| Rebuild Portion of Bridge over Russell | 43,000 | $100 | $4,300,000 | |
| Widen Dequindre with 4' Shldrs | 59,762 | $135 | $8,067,870 | |
| Remove/replace Existing Shoulder | 28,800 | $35 | $1,008,000 | |
| | | | $14,235,870 | |
| **Option 1 - Widen and Rebuild Portion of Dequidre Bridge** | | | | |
| Remove Portion of Bridge over Russell | 43,000 | $20 | $860,000 | |
| Rebuild Portion of Bridge over Russell | 43,000 | $100 | $4,300,000 | |
| Widen Dequindre with 4' Shldrs | 59,762 | $135 | $8,067,870 | |
| Re-Deck WB Dequindre | 157,804 | $35 | $5,523,140 | |
| | | | $18,751,010 | |
| | | Additional Cost = | $4,515,140 | |
| **Option 2 - Widen and Rebuild Portion of Dequindre Bridge with 14' Inside Shoulders** | | | | |
| Remove Portion of Bridge over Russell | 43,000 | $20 | $860,000 | |
| Rebuild Portion of Bridge over Russell | 43,000 | $100 | $4,300,000 | |
| Widen Dequindre with14' Shldrs | 107,762 | $135 | $14,547,870 | |
| Re-Deck WB Dequindre | 157,804 | $35 | $5,523,140 | |
| | | | $25,231,010 | |
| | | Additional Cost = | $10,995,140 | |
| **Option 3 - Widen and Rebuild Portion of Dequindre Bridge and Re-Deck All** | | | | |
| Remove Portion of Bridge over Russell | 43,000 | $20 | $860,000 | |
| Rebuild Portion of Bridge over Russell | 43,000 | $100 | $4,300,000 | |
| Widen Dequindre with 4' Shldrs | 59,762 | $135 | $8,067,870 | |
| Re-Deck All Dequindre | 315,608 | $35 | $11,046,280 | |
| | | | $24,274,150 | |
| | | Additional Cost = | $10,038,280 | |
| **Option 4 - Widen and Rebuild Portion of Dequindre Bridge and Re-Deck All with 14' Inside Shoulders** | | | | |
| Remove Portion of Dequindre | 43,000 | $20 | $860,000 | |
| Rebuild Portion of Dequindre | 43,000 | $100 | $4,300,000 | |
| Widen Dequindre with14' Shldrs | 107,762 | $135 | $14,547,870 | |
| Re-Deck All Dequindre | 315,608 | $35 | $11,046,280 | |
| | | | $30,754,150 | |
| | | Additional Cost = | $16,518,280 | |
| **Fill Dequindre Bridge Area - (only 4' shoulders for new construction - not included in options)** | | | | |
| Remove existing Dequindre | 359,830 | $20 | $7,196,600 | |
| 94 over Russell | 14,000 | $145 | $2,030,000 | 90 Single Span Full Height Abutments |
| 94 over RR | 15,300 | $145 | $2,218,500 | 90 Single Span Full Height Abutments |
| 94 over St Aubin | 15,300 | $145 | $2,218,500 | 90 Single Span Full Height Abutments |
| 94 over DPW | 27,600 | $145 | $4,002,000 | 160 Single Span Full Height Abutments |
| Fill Volume | 4,930,000 | $3.80 | $18,734,000 | Fill will need to be EPS Foam Block |
| (Exist. area - 4 bridge areas)*17ft. avg. | | | $36,399,600 | or equivalent |
| | | Additional Cost = | $22,163,730 | |
| **Option 5 - Fill Dequindre Bridge Area with 14' Inside Shoulders** | | | | |
| Remove existing Dequindre | 359,830 | $20 | $7,196,600 | |
| 94 over Russell | 14,000 | $145 | $2,030,000 | 90 Single Span Full Height Abutments |
| 94 over RR | 15,300 | $145 | $2,218,500 | 90 Single Span Full Height Abutments |
| 94 over St Aubin | 15,300 | $145 | $2,218,500 | 90 Single Span Full Height Abutments |
| 94 over DPW | 27,600 | $145 | $4,002,000 | 160 Single Span Full Height Abutments |
| Fill Volume | 5,746,000 | $3.50 | $20,111,000 | Fill will need to be EPS Foam Block |
| (Widen'd deck - 4 bridge areas)*17ft. avg. | | | $37,776,600 | or equivalent |
| | | Additional Cost = | $23,540,730 | |
| **Option 6 - Replace Remaining Existing Superstructure and Widen Substructure with 14' Inside Shoulders** | | | | |
| Remove existing Superstructure | 341,608 | $10 | $3,416,080 | |
| Widen Dequindre with14' Shldrs | 107,762 | $135 | $14,547,870 | |
| Replace Superstructure | 341,608 | $70 | $23,912,560 | |
| | | | $41,876,510 | |
| | | Additional Cost = | $27,640,640 | |
| **Rebuild Entire Proposed Dequindre Bridge - (only 4' shoulders for new construction - not included in options)** | | | | |
| Remove existing Dequindre | 359,830 | $20 | $7,196,600 | |
| Rebuild Entire Bridge | 418,370 | $100 | $41,837,000 | |
| | | | $49,033,600 | |
| | | Additional Cost = | $34,797,730 | |
| **Option 7 - Rebuild Entire Proposed Dequindre Bridge with 14' Inside Shoulders** | | | | |
| Remove existing Dequindre | 359,830 | $20 | $7,196,600 | |
| Rebuild Entire Bridge | 466,370 | $100 | $46,637,000 | |
| | | | $53,833,600 | |
| | | Additional Cost = | $39,597,730 | |

*Table V3a.2*

## I-94 Dequindre Bridge and New Adjacent Service Drives



### EXISTING CONDITIONS:

Currently, there is not an existing local road connecting Russell and St. Aubin Streets on either side of I-94 in the vicinity of the existing Dequindre structure. To supplement the operation of Waste Management Company and the city of Detroit's Department of Public Works (DPW) a gravel road has been established between Russell and St. Aubin for access to their buildings and properties using the abandoned Dequindre rail yard.

### AS DESIGNED:

The proposed I-94 rehabilitation project provides for continuous service drives along both sides of I-94. The proposed service drive on the south side of I-94 in the vicinity of the Dequindre Bridge will need be located quite close to the bridge and the Waste Management/DPW building.


*Exhibit V3b.1*
*As Designed*

The proposed vertical alignment of the service drive requires matching the grades at Russell and St. Aubin Streets. The service drive also needs to be elevated 25 ft. over the abandoned Dequindre rail yard to accommodate trucks using this abandoned rail bed to travel under the structure with their beds in the upright position. The service drive will also need to be elevated 23.5' over the active railroad crossing, just west of St. Aubin Street.

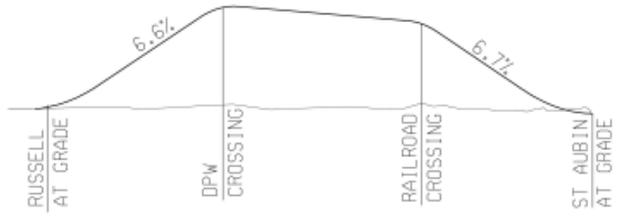



*Exhibit V3b.2*
*EB Service Drive*

Meeting all of the design criteria established will require a vertical upgrade of 6.6 percent from Russell Street and a 6.7 percent downgrade to St. Aubin.

The proposed vertical profile will also provide approximately 14' to 17' of clearance to the bottom of the superstructure in the vicinity of the Waste Management/DPW building.

The horizontal distance from the proposed wall to the DPW building is approximately 17 ft. Subsequent to the VE study, a suggestion was made by MDOT to provide an eight foot separation from the Dequindre bridges to the service drive bridges on either side. This would require the distance from the wall to the Waste Management/DPW building to approximately nine feet. Additional studies will be required to determine the impacts of the design and feasibility of shifting the service drives.

A similar grade situation will exist for the proposed new WB service drive between Russell and St. Aubin, except a grade approach of nine percent will be required near St. Aubin.

MDOT requests eight foot separation between new bridges and the existing Dequindre bridge deck, to allow use of bridge inspection equipment.

### VALIDATION OBSERVATION:

The VE Study finds that both the EB and WB 30-foot-wide service drives appear to be buildable as shown on the EPE base map furnished the VE team, based on the 10-day review and analysis of the EPE data we were furnished. The VE Study also identified that insufficient ROW information was available to assure that MDOT owns the land below, or that the thin ROW acquisitions shown as Proposed/Required accurately represents what MDOT knows based on previous ROW dealings in this industrial area. There will be approximately 17 ft. of horizontal separation between the structure or wall supporting the EB service drive and the Waste Management/DPW building (nine feet, if the eight foot separation of structures is provided). Additionally, it appears both service drives as drawn will have grades approaching seven and nine percent that will cause operational and maintenance problems if they provide at-grade intersections with Russell and St. Aubin as shown on the EPE base map furnished us.

**EXISTING CONDITION:**

The primary outlet for stormwater runoff from I-94 in the City of Detroit is the City of Detroit's Water and Sewerage Department's (DWSD) combined sewer system. Stormwater from local streets and sanitary sewerage also outlet to this city sewer system. Under dry weather conditions, sewage flows in the combined system to the Detroit Wastewater Treatment Plant near the confluence of the Rouge and Detroit Rivers. During rain events, the combined sewers cannot transport all of the stormwater sewerage flow, and overflows to the Rouge and Detroit Rivers occur.

The natural flow of the topography in the general area is southeasterly towards the Detroit River. The existing combined sewer system is constructed fairly shallow and typically follows major corridors to the Detroit River. The majority of these large combined sewers were constructed in the late 1800s and early 1900s. With the construction of the I-94 freeway in the 1950s, the depressed nature of I-94 caused many large combined sewers to be reconstructed in siphon-like fashion under the depressed freeway. The I-94 stormwater is collected at elevations lower than the adjacent combined outlet sewers, so the existing I-94 drainage system utilizes pump stations to raise the I-94 flows for outlet into the existing combined sewer system. Within the I-94 project limits of this review, there are 13 crossings of the I-94 depressed freeway by large combined sewers (48" to 16'-3" in diameter) and six pump stations that are used to collect mainline I-94 corridor flows and distribute them to the DWSD system. The crossing sites and pump station locations are as follows:

***I-94 Crosses These Combined Sewers:***

- 3' x 4" box
- 9'-0" cylindrical
- 9'-0" cylindrical
- 11'-6" cylindrical
- 3'-3" x 4'-4" box
- 48" cylindrical
- 30" cylindrical
- 1'-3" cylindrical
- 4' x 6' box
- 3'0" x 4'6" box
- 16'-3" cylindrical
- 42" cylindrical
- 3'-4" x 5'-0" box

***I-94 Pump Station Locations:***

| | |
|---|---|
| • 14th Street | Between mainline and service drive |
| • Hecla Avenue | Between mainline and service drive |
| • JC Lodge Expressway | In the southwest quadrant, west of southbound M-10 mainline |
| • Seneca Avenue | Between mainline and service drive |
| • Cadillac | Between mainline and service drive |
| • Conner Avenue | In the southwest quadrant, east of southbound Conner Avenue |

The service drives that exist along the I-94 corridor are connected to the existing DWSD system.

Based upon an assumed existing corridor width of 200 ft., the current I-94 contributory drainage area is estimated at approximately 170 acres. Variables include the amount of service drive area and interchange area (I-94/I-96 and I-94/I-75) that are tied into the existing I-94 drainage system.

**Drainage System** | **Validation 4** | **2 of 6**

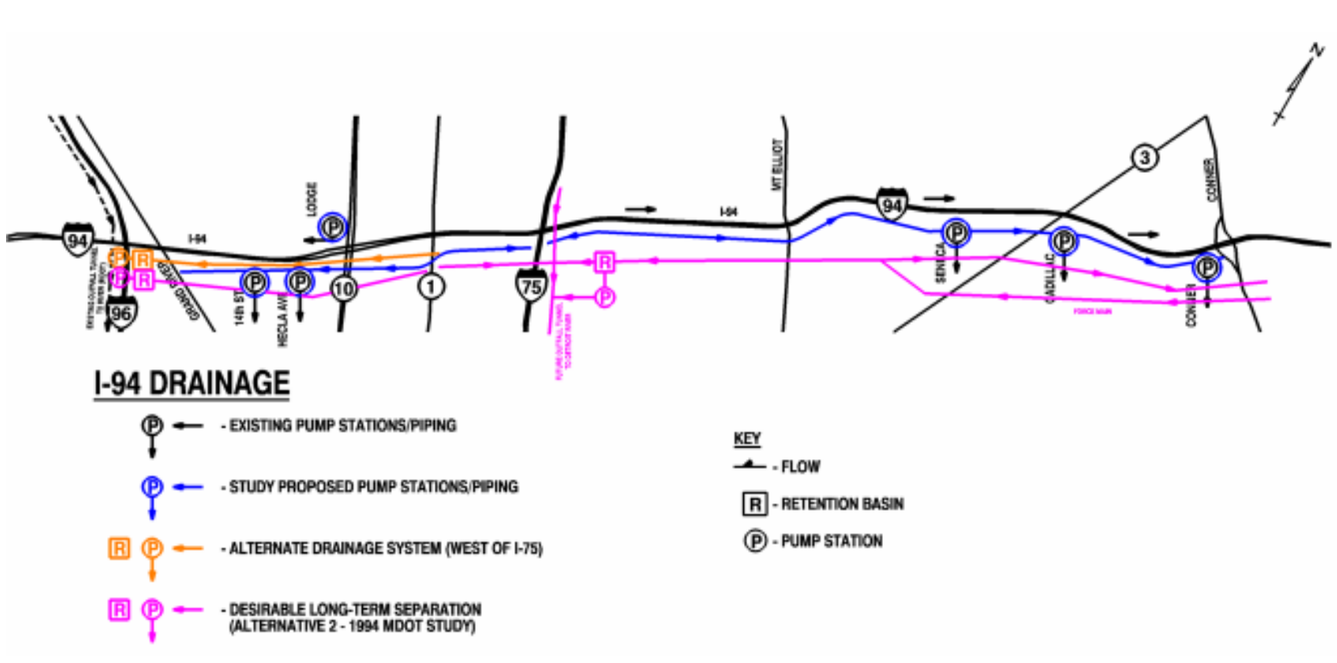
**AS DESIGNED:**

The VE Team's review of project study data received indicates that the proposed drainage system would be constructed to collect storm flows from the I-94 corridor in a manner similar to existing and would reconstruct the existing six pump stations while including sufficient detention to maintain a discharge rate no greater than the existing I-94 discharge. The detention was assumed to be in the interchange areas, where any additional flows greater than the existing would be detained and then released to the existing DWSD system. The current design uses a 60" storm sewer for eastbound mainline I-94 and a 60" storm sewer for westbound mainline I-94 for the entire project length.

It was stated in the project documents that the new service drives would be tied into the existing City combined system, although detention for the increased flows due to service drive widening and extensions was not specifically identified. The current design uses a 36" storm sewer for the eastbound frontage road and a 36" storm sewer for the westbound frontage road for the entire project length.

The current design also indicated that new 60" storm sewers would be included for northbound and southbound M-10.

The project data included a cost of $22.2 million for project drainage items and $12 million for pump station reconstruction.




*V4.1*
*I-94 Drainage Map*

| 36" RCP | | | |
|---|---|---|---|
| | Length | Unit Cost | Cost |
| WB Frontage | 34,730 | $75.00 | $2,604,750.00 |
| EB Frontage | 33,645 | $75.00 | $2,523,375.00 |
| M-10 SB Frontage | 7,600 | $75.00 | $570,000.00 |
| M-10 NB Frontage | 7,600 | $75.00 | $570,000.00 |
| **Subtotal** | | | **$6,268,125.00** |
| | | | |
| **60" RCP** | | | |
| | **Length** | **Unit Cost** | **Cost** |
| WB Mainline | 36,170 | $145.00 | $5,244,650.00 |
| EB Mainline | 35,640 | $145.00 | $5,167,800.00 |
| M-10 SB | 7,600 | $145.00 | $1,102,000.00 |
| M-10 NB | 7,600 | $145.00 | $1,102,000.00 |
| **Subtotal** | | | **$12,616,450.00** |
| | | | |
| **Drop Inlets (every 300' on ML & M-10; every 400' on service roads)** | | | |
| | **Quantity** | **Unit Cost** | **Cost** |
| WB Frontage | 88 | $4,200.00 | $369,600.00 |
| EB Frontage | 84 | $4,200.00 | $352,800.00 |
| WB Mainline | 242 | $4,200.00 | $1,016,400.00 |
| EB Mainline | 238 | $4,200.00 | $999,600.00 |
| M-10 SB | 52 | $4,200.00 | $218,400.00 |
| M-10 NB | 52 | $4,200.00 | $218,400.00 |
| M-10 SB Frontage | 19 | $4,200.00 | $79,800.00 |
| M-10 NB Frontage | 19 | $4,200.00 | $79,800.00 |
| **Subtotal** | | | **$3,334,800.00** |
| | | | |
| Pump Stations | 6 | $200,000.00 | **$12,000,000.00** |
| | | | |
| **Total** | | | **$34,219,375.00** |

*Table V4.1*
*As Designed Drainage Quantities*

**PROJECT VALIDATION:**

***As Designed Comments:***

Review of the project documents indicates the system proposed for the current design is feasible. As the design is conceptual in nature, several areas were identified that would need to be reviewed further to ensure the design and costs match the Recommended Alternative and that the project footprint is maintained. These are stated below:

***Pump Stations:***

The proposed project will require the reconstruction of six pump stations. A review was made to identify areas of pump station relocation that could occur within the project footprint. The identified pump stations and potential relocation areas are:

**I-94 EPE VE**

***Locations:***

- 14th Street — On Conrail property south of Kirby, will require agreement with railroad.
- Hecla Avenue — Between exit ramp and eastbound service drive, east of Rosa Parks, will require integration with retaining wall for exit ramp.
- JC Lodge Expressway — Relocation within the southwest quadrant of interchange.
- Seneca Avenue — Between mainline and service drive, will require integration with retaining wall for mainline
- Cadillac — Relocation to north of EB service drive, east of Gratiot within existing loop ramp area.
- Conner — Relocation within the SW quadrant of interchange.

Two of the above pump stations will probably require integration into the project retaining walls to facilitate placement. These are Hecla Avenue (see Exhibit V4.2) and Seneca Avenue (see Exhibit V4.3). In addition the 14th Street pump station will require retaining walls in the railroad embankment (see Exhibits V4.4 and V4.5) to provide a level site for pump station access and maintenance vehicles.

Early construction of the pump stations will provide a discharge location when working upstream.

*Exhibit V4.2*
*Existing Pump Station at Hecla, facing northwest*

*Exhibit V4.3*
*Existing Pump Station at Seneca, facing northwest*

*Exhibit V4.4*
*Existing Pump Station at 14th Street, facing northwest*

*Exhibit V4.5*
*Proposed Pump Station Location at 14th Street facing southeast*

***1994 Drainage Study:***

As part of the project overview the MDOT Detroit Freeway Drainage Study (1994) was provided. In this document it was identified that MDOT is concerned about the future impacts of continuing the discharge of freeway storm flows to the combined sewers of the DWSD. This is based upon the statement that MDOT is concerned about future costs of Combined Sewer Overflow (CSO) facilities being constructed by the City of Detroit and the impacts on future MDOT costs for use of the sewer system.

The 1994 study provides a summary of existing freeway drainage methodologies and four alternatives for handling discharges in the long-term. The most cost-effective approach identified by the study is to maintain the outlet of storm flows into the existing city system.

The most desirable of the four separation alternatives (Alternative 2) identified by the study for I-94 is a separation of depressed freeways with expanded retention facilities and sewer tunnel outfalls to the Detroit River. Alternative 2 was the basis for Options 2 and 3 as described below.

***Regulator Houses:***

The proposed project will require the reconstruction of two electrical regulator houses that feed the pump stations and freeway lighting. These houses are under the jurisdiction of the City of Detroit Public Lighting Department. Sufficient area exists for relocation within the project footprint.

Regulator House Locations:

- SE quadrant of I-94/M-10 interchange.
- SE quadrant of I-94/M-5 (Gratiot).

**VE PROPOSAL:**

As a part of the project validation, there were three identified options for the proposed drainage system.

***VE Option 1***

VE Option 1 proposes to replace the twin 60" sewers in the current design with a single 84" storm sewer for the I-94 mainline and M-10 mainline.

The current design has a cost of approximately $15.1 million for the twin 60" sewers and drop inlets.

| 60" RCP | | | |
|---|---|---|---|
| | Length | Unit Cost | Cost |
| WB Mainline | 36,170 | $145 | $5,244,650 |
| EB Mainline | 35,640 | $145 | $5,167,800 |
| M-10 SB | 7,600 | $145 | $1,102,000 |
| M-10 NB | 7,600 | $145 | $1,102,000 |
| **Subtotal** | | | **$12,616,450** |
| | | | |
| **Drop Inlets** | | | |
| | Quantity | Unit Cost | Cost |
| WB Mainline | 242 | $4,200 | $1,016,400 |
| EB Mainline | 238 | $4,200 | $999,600 |
| M-10 SB | 52 | $4,200 | $218,400 |
| M-10 NB | 52 | $4,200 | $218,400 |
| **Subtotal** | | | **$2,452,800** |
| | | | |
| **Total** | | | **$15,069,250** |

The cost of VE Option 1, with required cross leads and drop inlets would be approximately $8.9 Million.

| 84" RCP | | | |
|---|---|---|---|
| | Length | Unit Cost | Cost |
| Mainline | 36,170 | $175 | $6,329,750 |
| M-10 | 7,600 | $175 | $1,330,000 |
| **Subtotal** | | | **$7,659,750** |
| | | | |
| **Drop Inlets** | | | |
| | Quantity | Unit Cost | Cost |
| Mainline | 242 | $4,200 | $1,016,400 |
| M-10 | 52 | $4,200 | $218,400 |
| **Subtotal** | | | **$1,234,800** |
| | | | |
| **Total** | | | **$8,894,550** |

***Advantages:***

- Less excavation.
- Lower material costs.
- Fewer manholes.

***Disadvantages:***

- No redundancy in system.
- Limits options for phased construction.
- Will require temporary drainage during construction.

***Preliminary Reduction in Construction Cost Estimate:***

The cost of VE Option 1 will be approximately $6.2 million less than the As Designed.

***VE Option 2:***

VE Option 2 option uses the existing I-96 MDOT tunnel outfall located in the I-94/I-96 interchange to provide an outlet for the western portion of the I-94 mainline drainage between I-96 and M-1 (Woodward Avenue). This option is identified as part of Alternative 2 in the 1994 MDOT Detroit Freeway Drainage Study.

This option would eliminate the need for reconstruction of the 14th Street and Hecla pump stations. This system would potentially act as a gravity system due to the existing depth of the MDOT Detroit River Outfall. Over-sizing of the system would provide for detention as the system will need to be designed to prevent surcharging the downstream pipe. Metering of the new system into the existing I-96 tunnel outfall will be required. Costs for the construction of one pump station in the I-94/I-96 interchange are included as a metering measure.

The cost of the current design from I-96 to M-1 (Woodward Avenue) is approximately $7.0 million.

| 60" RCP ( Project Length = 3,600') | | | |
|---|---|---|---|
| | Length | Unit Cost | Cost |
| | 8,600 | $145 | $1,247,000 |
| | 8,600 | $145 | $1,247,000 |
| | | | |
| **Pump Stations** | | | |
| | Quantity | Unit Cost | Cost |
| | 2 | $2,000,000 | $4,000,000 |
| | | | |
| **Drop Inlets** | | | |
| | Quantity | Unit Cost | Cost |
| | 60 | $4,200 | $252,000 |
| | 60 | $4,200 | $252,000 |
| | | | |
| **Total** | | | **$6,998,000** |

The cost to construct VE Option 2 is approximately $2.8 million without a pump station and $5.5 million with a pump station.

VE Option 2 can also include the VE Option 1 concept of replacing the twin 60" system with a single 84".

| 84" (I-96 to M-1 = 9,800') | | | | |
|---|---|---|---|---|
| | Length | Unit Cost | Cost | Total |
| | 8,600 | $175 | $1,505,000 | $1,505,000 |
| **84" Tunnel** | | | | |
| | 1,200 | $800 | $960,000 | $960,000 |
| | | | | |
| **Pump Station** | | | | |
| | Quantity | Unit Cost | Cost | |
| | 1 | $3,000,000 | $3,000,000 | $3,000,000 |
| | | | | |
| **Drop Inlets** | | | | |
| | Quantity | Unit Cost | Cost | |
| | 60 | $4,200 | $252,000 | |
| | 10 | $4,200 | $42,000 | $294,000 |
| | | | | |
| **VE Option 2 w/o pump station** | | | **$2,759,000** | |
| **VE Option 2 w/pump station** | | | **$5,759,000** | |

***Advantages:***

- Eliminates connection to DWSD system in the I-96 to M-1 (Woodward Avenue) segment.
- Potential elimination of 1-2 pump stations.
- Potential for less maintenance.
- Early construction provides outfall when working upstream.

***Disadvantages:***

- Requires detention to prevent surcharging.
- Will require tunneling into I-96 interchange to eliminate traffic conflicts.

***Preliminary Reduction in Construction Cost Estimate:***

VE Option 2 costs approximately $4.2 million less than the As Designed without a pump station and $1.5 million less with a pump station.

***Option 3:***

VE Option 3 uses the existing MDOT tunnel outfall located in the I-94/I-96 interchange to provide an outlet for I-94 mainline drainage from I-96 to M-1 (Woodward Avenue) and a new tunnel located within the I-75 right-of-way from I-94 southerly to the I-375 right-of-way and outfall to the Detroit River. This option is identified as the full build-out of a separated system as part of Alternative 2 in the 1994 MDOT Detroit Freeway Drainage Study.

This option would eliminate the need for reconstruction of the five existing pump stations in the project corridor. This system would potentially act as a gravity system due to the existing depth of the MDOT Detroit River Outfall in the I-96 to M-1 segment. Oversizing of the system would provide for detention as the system will need to be designed to prevent surcharging the downstream pipe. Costs for the construction of one pump station in the I-94/I-96 interchange are included as a metering measure.

The segment from M-10 to east of I-75 would act as a gravity system flowing to I-75. The segment from east of I-75 to Conner Avenue would be a gravity system flowing easterly to Conner Avenue, utilizing a force main to pump the flows back to the I-75 interchange. A new pump station and pipe detention would be located in the I-94/I-75 interchange, with pumping to the proposed I-75 tunnel.

The current design has a cost of approximately $24.4 million for the twin 60 in. sewers, drop inlets and pump stations.

| Pump Stations | | | | |
|---|---|---|---|---|
| | Quantity | Unit Cost | Cost | Total |
| | 6 | $2,000,000 | $12,000,000 | $12,000,000 |
| **60" RCP** | | | | |
| | Length | Unit Cost | Cost | |
| | 36,170 | $145 | $5,244,650 | |
| | 35,640 | $145 | $5,167,800 | $10,412,450 |
| **Drop Inlets** | | | | |
| | Quantity | Unit Cost | Cost | |
| | 242 | $4,200 | $1,016,400 | |
| | 238 | $4,200 | $999,600 | $2,016,000 |
| | | | | |
| **Total** | | | | **$24,428,450** |

The cost of VE Option 3 is approximately $62.0 to $65.0 million based on whether a pump station is required at the I-94/I-96 interchange.

VE Option 3 also includes the Option 1 concept of replacing the twin 60" system with a single 84".

| | | | | |
|---|---|---|---|---|
| **VE Option 3 = (VE Option 2) + (Work from M-1 to Conner)** | | | | |
| **VE Option 2** | | | | $2,759,000 |
| | | | | $5,759,000 |
| **Work from M-1 to Conner** | | | | |
| **Pump Station** | | | | |
| | **Quantity** | **Unit Cost** | **Cost** | **Total** |
| 100 CFS | 2 | $2,500,000 | $5,000,000 | |
| 250 CFS | 1 | $5,000,000 | $5,000,000 | $10,000,000 |
| | | | | |
| **84" RCP** | | | | |
| | **Length** | **Unit Cost** | **Cost** | **Total** |
| | 26,400 | $175 | $4,620,000 | $4,620,000 |
| | | | | |
| **48" Force Main (Van Dyke to Conner)** | | | | |
| | **Length** | **Unit Cost** | **Cost** | **Total** |
| | 11,000 | $800 | $8,800,000 | $8,800,000 |
| | | | | |
| **96" Tunnel (I-94 to Detroit River)** | | | | |
| | **Length** | **Unit Cost** | **Cost** | **Total** |
| | 15,000 | $1,000 | $15,000,000 | $15,000,000 |
| | | | | |
| **Misc. Detention (I-75 and River Outfall)** | | | | |
| | **Quantity** | **Unit Cost** | **Cost** | **Total** |
| | 2 | $2,000,000 | $4,000,000 | $4,000,000 |
| | | | | |
| **Drop Inlets** | | | | |
| | **Quantity** | **Unit Cost** | **Cost** | **Total** |
| | 176 | $4,200 | $739,200 | $739,200 |
| | 2,500 | $3,000 | $7,500,000 | $7,500,000 |
| | | | | |
| **Access Shafts (50 Shafts x 50')** | | | | |
| | | | | |
| | **Length** | **Unit Cost** | **Cost** | **Total** |
| **36" RCP** | 34,730 | $75 | $2,604,750 | |
| | 33,645 | $75 | $2,523,375 | |
| **60" RCP** | 7,600 | $145 | $1,102,000 | |
| | 7,600 | $145 | $1,102,000 | $6,230,125 |
| **Inlets** | | | | |
| | **Quantity** | **Unit Cost** | **Cost** | **Total** |
| | 159 | $4,200 | $667,800 | |
| | 155 | $4,200 | $651,000 | $8,650,925 |
| | | | | |
| **Summary - Work from M-1 to Conner** | | | | **$59,310,125** |
| | | | | |
| **Cost of VE Option 3** | | | | |
| | | | | |
| **Without pump station** | | | | **$62,069,125** |
| **With pump station** | | | | **$65,069,125** |

***Advantages:***

- Eliminates connection to DWSD system for mainline I-94 in the entire project corridor.
- Allows future drainage extension to pick up I-94 mainline flows from Conner easterly to M-102 (Eight Mile Road).
- Potential elimination of six existing pump stations, with construction of two new large pump stations.
- Provides outfall for future separation of I-75 drainage from the Detroit River northerly to M-102 (Eight Mile Road).

***Disadvantages:***

- Requires construction of a new tunnel outfall to the Detroit River that is required to be sized to accommodate flows much larger than the I-94 project requires.
- More costly option.
- Requires detention to prevent surcharging.
- Requires force main from M-53 (Van Dyke) to Conner Avenue due to I-94 being low in elevation.
- Current design can potentially use same approach in the future but have pump stations flow into a future tunnel sewer located in the service drive area.
- Will require tunneling into I-96 interchange to eliminate traffic conflicts.

***Preliminary Additional Construction Cost Estimate:***

The cost of the VE Option 3 will be approximately $40.6 million more than the As Designed.

| First Cost | | | |
|---|---|---|---|
| **Item** | **As Designed** | **VE Proposal** | **Cost Difference** |
| VE Option 1 | $15,100,000 | $8,900,000 | $6,200,000 |
| VE Option 2 | $7,000,000 | $2,800,000 | $4,200,000 |
| VE Option 3 | $24,400,000 | $65,000,000 | ($40,600,000) |

**VALIDATION OBSERVATION:**

The VE Study finds that the drainage appears to be buildable as shown on the EPE base map and in the manner of intended work furnished the VE team, within the footprint indicated, based on the 10-day review and analysis of the EPE data we were furnished. The VE Study also identified that it might be more economical if a single 84" pipe were used within the new I-94 mainline corridor instead of the existing concept of twin 60" pipes, and if the drainage west of M-1 (Woodward Avenue) were conveyed into a new retention chamber before being outletted into the existing I-96 tunnel sewer MDOT built to convey I-96 stormwater to the Detroit River. The VE Study also identified that two existing pump stations might not be required west of Woodward Avenue if the drainage in the west segment were outletted to the I-96 tunnel, and that two Public Lighting Department (PLD) Electrical Regulator Houses were field observed that will need to be relocated (located at I-94/M-10 interchange and the I-94/Gratiot interchange) but are not identified on the aerial mapping and do not appear in the DEIS Cost Estimate.

Due to the complexity of this project and to fulfill all previously negotiated commitments, special attention is needed at the project development and delivery stages so that the construction proceeds as smoothly as possible.

The successful execution of the I-94 Reconstruction Project requires a contracting strategy that addresses certain local conditions and other issues that are inherent with a project of this size and scope. Issues to be considered include:

- Developing the size of contracts to address the local contracting community's ability to get the work accomplished within their bonding capacity and without overwhelming the available work force.
- Packaging of the contracts to best utilize available funding providing contractor access, staging areas and portable plant sites.
- The need for concentrated resources for utility relocations of the public and private utilities.
- Recognition and accommodation of special regional events in the greater Detroit area.
- Being sensitive to the needs of the various stakeholders including the motoring public and the adjacent property owners and businesses.
- Partnering and coordination efforts with all elements of the project including MDOT, the contractor, the public, etc.
- Nonhazardous contaminated materials identification and other environmental issues such as asbestos, underground storage tanks, lead based paint, air quality, soil erosion and sedimentation and noise.
- Identify the impacts of the proposed construction on the existing railroads and develop agreements and special provisions for coordination and work at railroad properties.
- Understanding of local community impacts such as homeless people residing at two known interchanges (I-75 and M-10).
- Development of a media relations strategy to announce the project including radio, television, MDOT website, and informational fliers.

***Contracting Strategies:***

Several contracting strategies have been proven successful on both previous MDOT projects and other mega projects nationally. Some examples of these strategies for consideration on the I-94 Project include:

- Relocate utilities prior to award of major roadway and bridge contracts.
- Awarding advance contracts prior to the major roadway or bridge contracts.
- Contractor workshops in advance of bid lettings.
- Notification to Suppliers of special materials requirements and innovative design elements.
- Innovative Claims Avoidance techniques such as providing a lump sum line item as a contractor contingency for claims and/or a bonus for no claims.
- Pre-bid meetings.
- Use completion date contracts vs. work day contracts.
- Innovative contracting including A+B Contracting with Incentive/Disincentive, Lane Rentals, Ramp Rentals, and Special Provision for Extension of Time on Incentive/Disincentive Projects.
- Material purchase contracts (such as structural members).

***Program Management:***

Program Management has been an extremely important tool in the delivery of past mega projects and programs. Some of the items that have been addressed with the use of a Program Manager include:

- Utility Relocation and Coordination.
- ROW Coordination.
- Contract Coordination.
- Schedule management - especially good for documentation for use in the review of any claims for delay or extension of time.
- Maintenance of Traffic Coordination/Contract Interface.
- Public Involvement Issues (i.e., General Motors coordination, community involvement).
- Emergency services coordination.
- Consistent corridor aesthetic treatments.
- Consistent contract specifications, plans and details.
- Traffic Management Plan with Incident Management Elements and use of Potential ITS Technologies.
- Project Funding and Budgetary Analysis.

***Potential Maintenance of Traffic Schemes:***

Early in the VE process, various MOT schemes were considered. Some of these schemes included:

*Reconstruction of I-94 While Maintaining Traffic on I-94:*

Reconstruction of I-94 while maintaining traffic was considered and dismissed as it would require closing one through lane per direction to build the widened section. In this scheme, two lanes of traffic would be kept open at all times on I-94 to allow the reconstruction and lowering to proceed on the outside of the roadway. The two available lanes would be express lanes and would not have the option during the first stage to enter or exit I-94 within the construction site. During the second stage of construction, traffic would shift to the outside and be able to exit the roadway. Traffic would not be allowed to enter to eliminate weave movements. This option is viable although existing traffic volumes on I-94 indicate that the corridor would experience severe delays when only two through lanes are available. This option would require that the distance between the bottom of the new cross street bridges and top of existing pavement be checked to determine if underclearance requirements will be met during all construction stages. This option does not include shoulders for vehicle refuge (breakdown lane) and will require the contract expense of having continuous tow truck service available. It also potentially requires expensive and time intensive temporary sheet piling to be installed for the length of the project. It will involve increased maintenance of traffic costs such as temporary concrete barrier, temporary pavement markings, barricades, and signing.

*Full Closure Staging Options on I-94:*

Various options involving full closure of I-94 were analyzed and were considered the most feasible alternatives. These are explored further in the remainder of this section. The complete closure of an interstate is not unheard of and is becoming more common to provide a higher quality finished product under an accelerated construction schedule. For example, full closure was utilized on a three mile section of I-75 in downtown Detroit in 1998. The base premise of all of these alternatives is the relocation of all utilities in advance of the construction work. Many of these alternatives also consider the building of the service drives in advance of the mainline I-94 construction. The construction timeframes for each of these alternatives are conservative and the stages of work are assumed to be performed sequentially rather than concurrently. It may be possible to complete construction of some of these stages concurrently, but any detour routes proposed in conjunction with the staged construction should be checked for conflicts. The construction staging alternatives analyzed follow.

***Staging Alternative # 1 – Full Closure West of I-75/Partial Closure East of I-75:***

The base premise of this alternative is the relocation of utilities and the construction of the service drives in advance of I-94 mainline construction. The advantages and disadvantages of this alternative are as follows.

***Advantages:***

- Utilities are relocated in advance to avoid construction conflicts.
- Service drives provide continuous connections to local communities.
- Maintain through access with three lanes of I-94 in one direction for one year during construction.
- Westbound mainline done first to maintain temporary drainage utilizing existing pump stations on the EB side – minimizes temporary drainage costs.
- Maintains access to downtown.
- All north/south connectors, e.g. M-10, M-3, Van Dyke, to remain open at all times.

***Disadvantages:***

- Nine-year construction season (conservatively) is the longest time frame.
- Increased construction time along mainline.
- Access within the corridor is limited.
- MOT more costly.
- Temporary ramps, barricades, temporary concrete barrier wall, etc. are required.
- Less safe, more dangerous to workers and motorists
- Quality control is an issue.
- Less workspace available for contractor staging area.
- Requires that the distance between the bottom of the new cross street bridges and the top of existing pavement be checked to determine if underclearance requirements will be met.

Exhibit V5.1 graphically depicts the order of work progression.

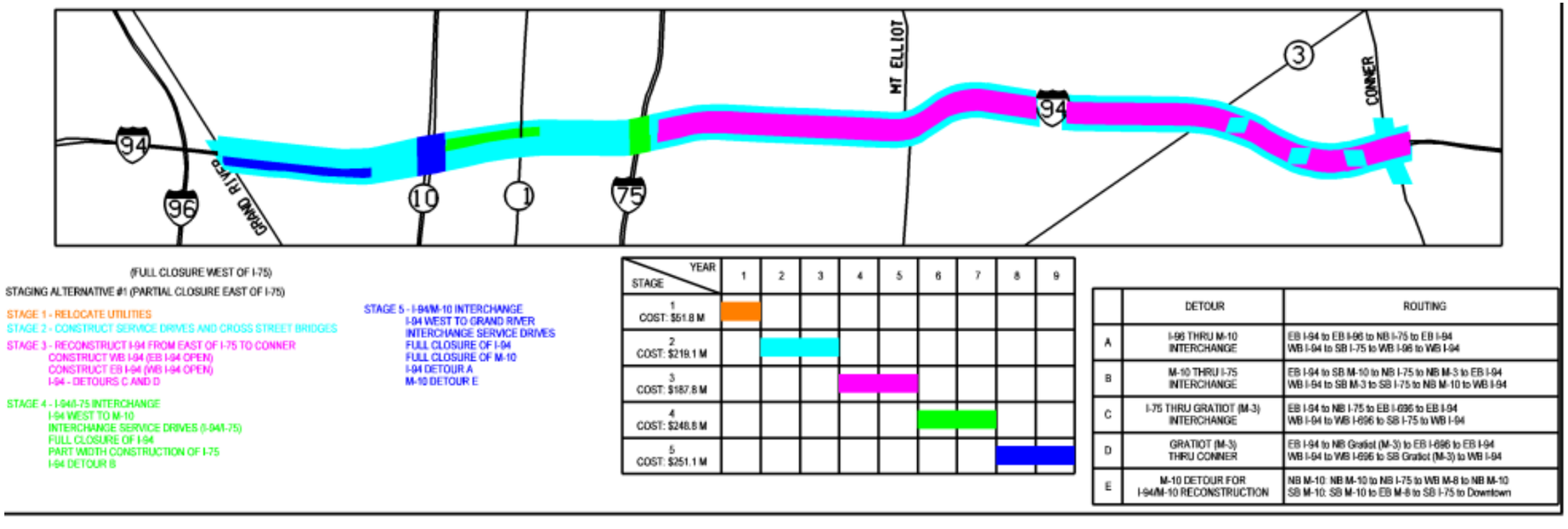



*Exhibit V5.1*
*Staging Alternative 1*

***Staging Alternative # 2 – Full Closure by Segment***

The base premise of this alternative is that the utilities are relocated in advance of any construction and the project is subdivided into segments for full closure. This allows construction of all elements (i.e., services drives, I-94 mainline, and cross street bridges) to occur at the same time within the closed segment. This alternative provides:

- Expedited Project completion.
- Reduced impact of construction on travelers.
- Maximized workspace available to the contractor and increased productivity.
- Reduction of overall congestion resulting from construction.
- Improved safety for workers and travelers.
- Reduced crashes in some cases.
- Better achievement of quality product such as a smoother roadway.

The advantages and disadvantages of this alternative are as follows.

***Advantages:***

- Seven year construction duration (conservatively).
- Potential for cost savings with increased productivity.
- Minimizes disruptions to adjacent neighborhoods.
- Better quality control of the finished product.
- Better overall efficiency of progression of work results in a cheaper price.
- Reduced MOT costs – move traffic once and leave them there.
- Construction staging conflicts are eliminated as no traffic is maintained in the work zone.

***Disadvantages:***

- Concentrated construction impacts in one area. Impacts to the adjacent neighborhoods during the 24-hour operations.
- No public access through the segment on either the service road or the freeway.
- During a full closure, there may be greater potential for theft or vandalism on the construction site. Additional security arrangements will be need to be made.

Exhibit V5.2 graphically depicts the order of work progression.

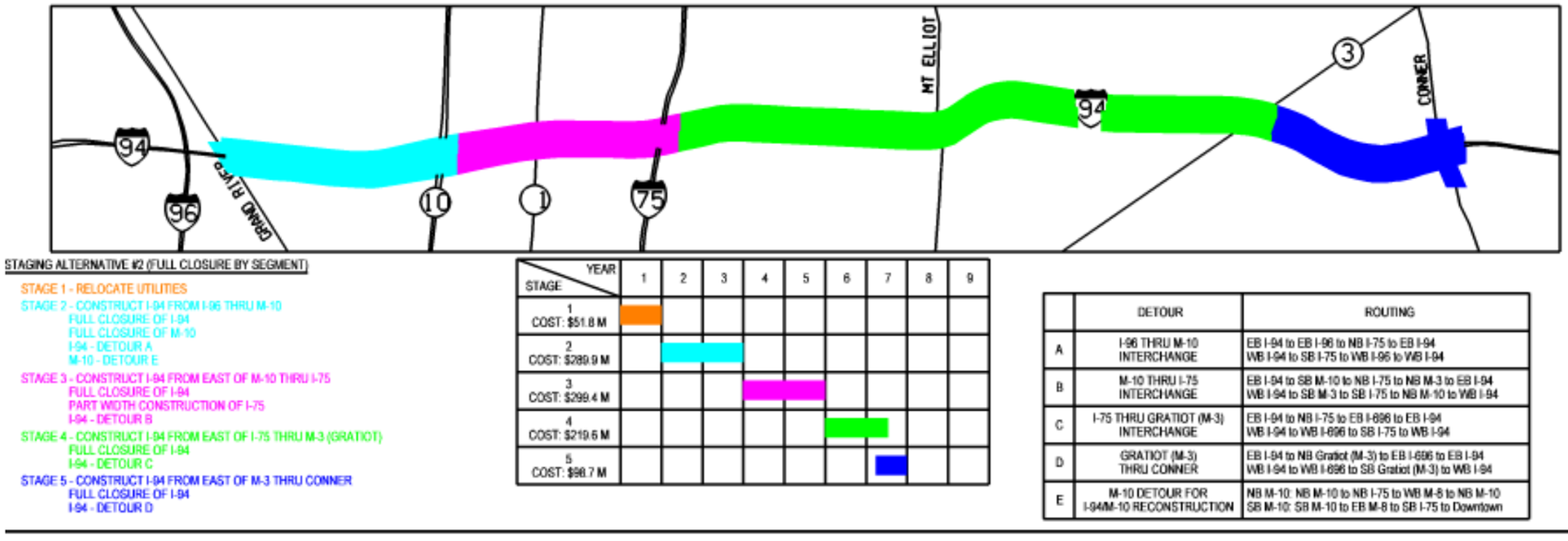



*Exhibit V5.2*
*Staging Alternative 2*

***Staging Alternative #3 – Full Closure by Segments – Advanced Construction of Service Drives and Bridges:***

The base premise for this alternative is that the utilities are relocated and the service drives and cross street bridges are constructed in advance of mainline I-94 construction. Mainline I-94 construction then takes place utilizing closures by segment. This alternative provides:

- Expedited project completion.
- Reduced impact of construction on travelers.
- Maximized workspace available to the contractor and increased productivity.
- Reduction of overall congestion resulting from construction.
- Improved safety for workers and travelers.
- Reduced crashes in some cases.
- Better achievement of a quality product such as a smoother roadway.

The advantages and disadvantages of this alternative are as follows.

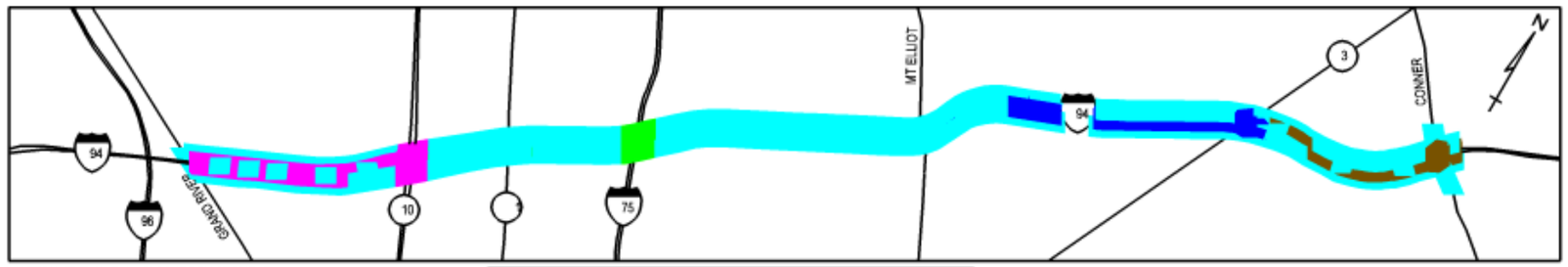
***Advantages:***

- Potential for cost savings with increased productivity.
- Minimizes disruptions to adjacent neighborhoods.
- Better quality control of the finished product.
- Better overall efficiency of progression of work results in a cheaper price.
- Reduced MOT costs – move traffic once and leave them there.
- Construction staging conflicts are eliminated as no traffic is maintained in the work zone.
- Service drives provide continuous connections to local communities.
- Less disruptive than full segment construction.

***Disadvantages:***

- Nine year construction duration (conservatively).
- Concentrated construction impacts in one area. Impacts to the adjacent neighborhoods during the 24-hour operations.
- During a full closure, there may be greater potential for theft or vandalism on the construction site. Additional security arrangements will be need to be made.

Exhibit V5.3 depicts graphically the order of the work progression.




STAGING ALTERNATIVE #3 (FULL CLOSURE BY SEGMENT ADVANCE CONSTRUCTION OF SERVICE DRIVES AND CROSS STREET BRIDGES)

STAGE 1 - RELOCATE UTILITIES
STAGE 2 - CONSTRUCT SERVICE DRIVES AND CROSS STREET BRIDGES
STAGE 3 - CONSTRUCT I-94 FROM I-96 THRU M-10
FULL CLOSURE OF I-94
FULL CLOSURE OF M-10
I-94 - DETOUR A
M-10 - DETOUR E
STAGE 4 - CONSTRUCT I-94 FROM EAST OF M-10 THRU I-75
FULL CLOSURE OF I-94
PART WIDTH CONSTRUCTION OF I-75
I-94 - DETOUR B
STAGE 5 - CONSTRUCT I-94 FROM EAST OF I-75 THRU M-3 (GRATIOT)
FULL CLOSURE OF I-94
I-94 - DETOUR C
STAGE 6 - CONSTRUCT I-94 FROM EAST OF M-3 THRU CONNER
FULL CLOSURE OF I-94
I-94 - DETOUR D

| STAGE \ YEAR | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| 1 COST: $51.8 M | | | | | | | | | |
| 2 COST: $219.1 M | | | | | | | | | |
| 3 COST: $251.1 M | | | | | | | | | |
| 4 COST: $248.8 M | | | | | | | | | |
| 5 COST: $139.4 M | | | | | | | | | |
| 6 COST: $48.4 M | | | | | | | | | |

| | DETOUR | ROUTING |
|---|---|---|
| A | I-96 THRU M-10 INTERCHANGE | EB I-94 to EB I-96 to NB I-75 to EB I-94<br>WB I-94 to SB I-75 to WB I-96 to WB I-94 |
| B | M-10 THRU I-75 INTERCHANGE | EB I-94 to SB M-10 to NB I-75 to NB M-3 to EB I-94<br>WB I-94 to SB M-3 to SB I-75 to NB M-10 to WB I-94 |
| C | I-75 THRU GRATIOT (M-3) INTERCHANGE | EB I-94 to NB I-75 to EB I-696 to EB I-94<br>WB I-94 to WB I-696 to SB I-75 to WB I-94 |
| D | GRATIOT (M-3) THRU CONNER | EB I-94 to NB Gratiot (M-3) to EB I-696 to EB I-94<br>WB I-94 to WB I-696 to SB Gratiot (M-3) to WB I-94 |
| E | M-10 DETOUR FOR I-94/M-10 RECONSTRUCTION | NB M-10: NB M-10 to NB I-75 to WB M-8 to NB M-10<br>SB M-10: SB M-10 to EB M-8 to SB I-75 to Downtown |

*Exhibit V5.3*
*Staging Alternative 3*

## Construction Staging and Scheduling



***Alternative Perimeter Routing:***

The use of alternate routing techniques is essential to the successful construction of the I-94 Project. Critical routes would be identified in advance of construction and signed at appropriate locations so that the construction site could be avoided entirely including:

- I-69 for routing to and from the Blue Water Bridge.
- US-23 to I-96 to I-696 (Ann Arbor to the north Detroit suburbs).
- I-275 to I-696 (perimeter routing around Detroit).
- US-24 to I-696 (perimeter routing around Detroit).

***Detour Routing:***

Although not signed as detour routing, several local trunklines within the City of Detroit will be utilized by the motoring public.

Signed detour routing necessary to implement the staging alternatives discussed above are shown in Exhibit V5.4. These have been used successfully on prior I-94 rehabilitation construction projects. Traffic not destined to reach the downtown Detroit area will utilize the alternate perimeter routing discussed above. Although it is recognized that the detour routes may be approaching capacity, traffic has traditionally dispersed throughout the local road systems to avoid delays. For both of these reasons, the full volume of I-94 traffic is not expected to be channeled to any single trunkline within the construction influence area.

**VALIDATION OBSERVATION:**

The VE Study finds that the intended freeway and service road construction appears to be buildable as shown on the EPE base map furnished to the VE team, within the footprint indicated, based on the 10-day review and analysis of the EPE data we were furnished. The VE Study also identified that the FEIS should preclude the use of restrictive wording related to detour options for I-94 traffic at this EPE level of knowledge. It was determined that allowing the Contractor access to the full I-94 mainline will reduce the construction and detour time by years as well as provide approximately $40 million in cost savings in the item of Temporary Sheet Piling required for part-width I-94 construction. Three construction staging schemes were developed that all show construction may conservatively take seven to nine years with main sequential contracts each about $250-$275 million in program cost with all or some portions of total closure in the I-94 construction segment. Further refinement of the actual construction packages into sizes manageable by the local contracting community should occur as part of the engineering report. The VE Study also determined that replacing failed existing I-94 bridges with new bridges to accommodate the new widened I-94 will be difficult because of underclearance and pier and abutment placement problems but should be evaluated on a case by case basis during the next phase of design or as required.

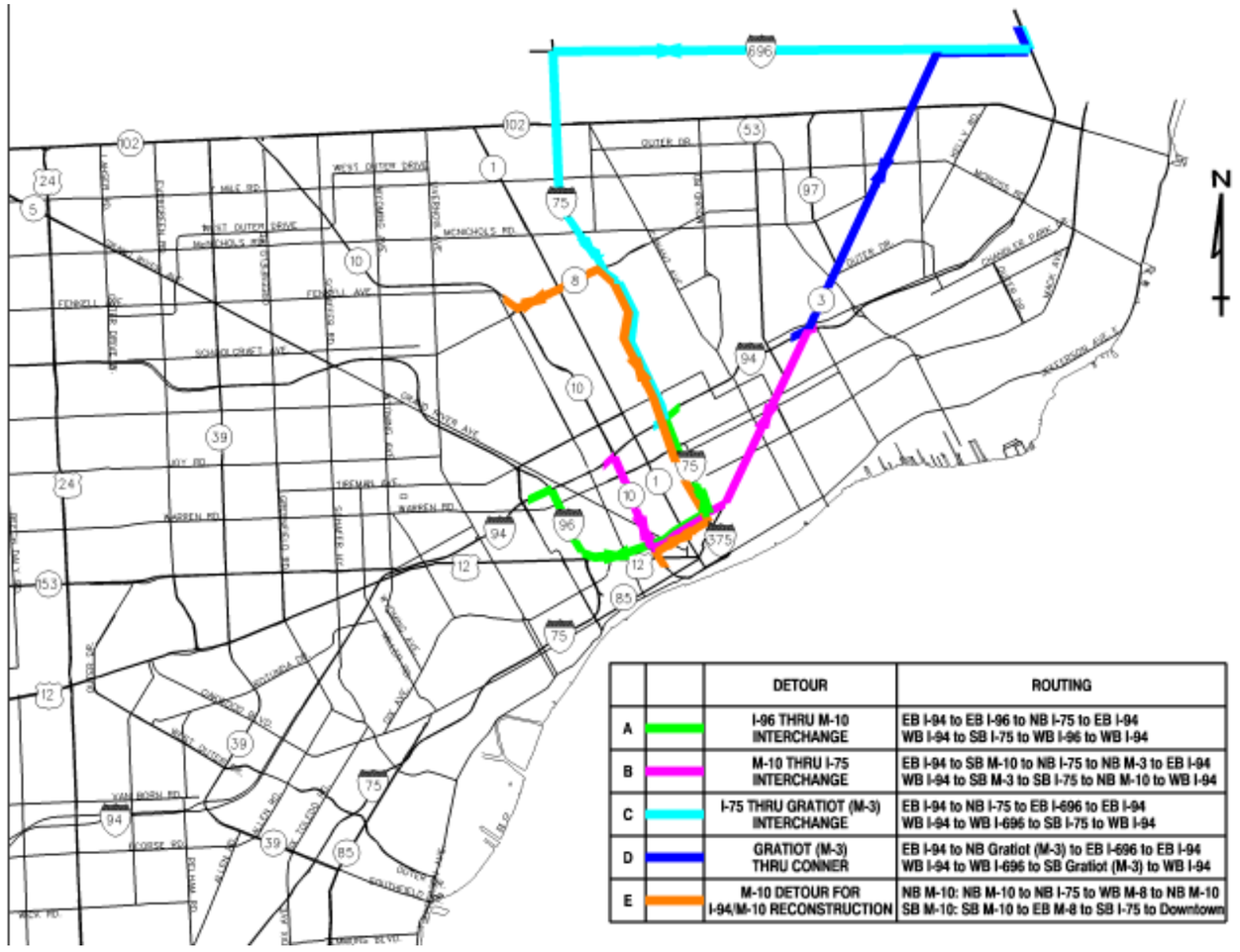



*Exhibit V5.4*
*Detour Routing*

***Types of Retaining Walls:***

This proposal describes the different retaining wall types and associated unit costs that can be considered for this project.

***Post and Panel (P&P) Wall:***

The post and panel wall system is a "top-down" wall system that has two basic components: soldier piles (also referred to as the "shafts" or "posts") and lagging. The soldier piles are usually set at 6 to 10-foot spacing and are typically designed to carry the full lateral earth pressure load. The lagging spans the horizontal distance between the soldier piles and is typically designed to resist relatively minor earth pressure loads. The most commonly used soldier piles are rolled steel sections (such as wide flange or H shape). However, soldier piles can be almost any structural member — pipe section, cast-in-place concrete, or precast concrete.

Initial lagging is most commonly timber, but may also consist of light steel sheeting or corrugated guardrail sections. Timber lagging is most commonly installed behind or in front of the flange next to the excavation (front flange). The lagging can either bear directly against the soil side (back-side) of the front flange or it can be wedged to make more intimate contact with the soil and thus reduce associated lateral displacement. Lagging is attached to the soldier pile either at the front or the back side of the front flange using various methods.

One distinguishing feature of attaching lagging boards to the front face is that the lagging can run continuously across several soldier piles. This is not possible when lagging is installed behind the front flange.

Soldier piles are installed either by drilling or by driving into the bearing strata, the former being the most commonly used method. For the drilled-in option, pre-bored holes are drilled from the ground surface down to the design tip


*Exhibit P1.1*

elevation at a constant horizontal spacing along the wall length. The soldier piles are then placed in the holes and the portions of the holes below the excavation level are grouted using a structural concrete mix.

After the grout has set around the soldier piles, the soil is excavated in front of the piles down to the final proposed grade. As the excavation proceeds, timber lagging (or planks) are installed between the soldier piles to support the cut face. Typically, in sandy soils the excavated unsupported soil height is limited to only two feet. The drilled-in soldier pile option can be used with precast lagging or with cast-in place concrete facing as the final lagging.

The driven soldier pile option is appropriate only for cast-in-place concrete facing. Using this option is not recommended if precast lagging will be used, because the precise spacing required for precast lagging system is not typically achieved within driving tolerances of the piles, especially where hard driving conditions are expected or where the subsurface materials contain cobbles and boulders.

The post and panel wall system will not require any additional lateral support or tiebacks if the wall height is relatively low. Typically, P&P wall posts can be cantilevered up to 16-feet-high without surcharge and adequate passive resistance in front of the wall.

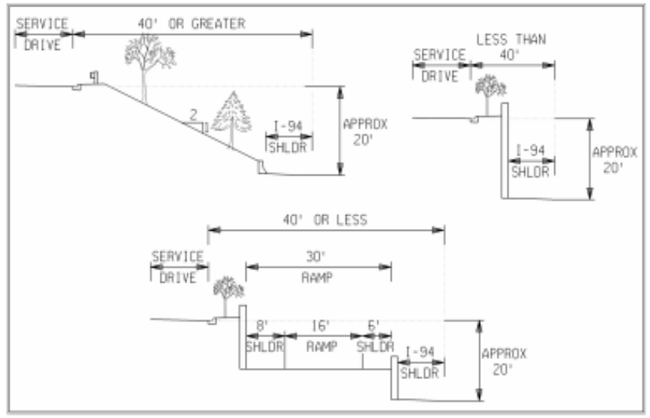



*Exhibit P1.2*

If a surcharge load is applied behind the wall, the cantilevered height should be reduced to 12 ft. or less. The lagging retains the soil and the load is transferred to the soldier piles. For the cantilevered post and panel system, the soldier pile acts as a cantilevered beam that resists the lateral earth pressure loads through the stiffness of the pile-concrete section and through passive resistance developed in the embedded portion of the piles.

The unit price for this wall type ranges from $97 to $133 per square foot, which increases at a greater rate with higher walls that may require one to two rows of tiebacks. The unit price includes the price of tiebacks for exposed wall heights greater than 16 ft.

***Secant and Tangent Pile Wall:***

This "top-down" wall system is constructed by installing overlapping or tangent drilled shafts with either a steel core or a rebar cage and in some instances with both a rebar cage and steel core. The secant or tangent pile wall is usually constructed by high torque rotary drilling equipment. The wall is constructed in two stages: All shafts constructed during Stage 1 are known as primary (female) shafts. These are spaced at the specified primary secant shaft spacing. All

shafts constructed during Stage 2 are known as secondary (male) shafts. These are positioned between the primary shafts and are overlapped (i.e. secant) or tangent with the primary shafts. Guide walls shall be used at the ground surface to ensure positional tolerance. Construction for this wall type is typically "top-down" construction, meaning that lane closures are not required, as construction equipment will be working uphill and behind the walls. After setup of the drilled shafts, the soil in front of the wall is excavated and final facing is constructed for aesthetic purposes.

Secant pile installation is performed by specialty contractors. The number of such contractors that can bid on this wall system may be limited, increasing cost incrementally beyond normal competitive rates.

The drilled shafts carry the full earth pressure and cut off the ground water, bypassing the wall through clay that has relatively low permeability. Therefore, the risk of settlement of adjacent structures and utilities is minimal. Another important advantage of using this wall system is that the construction can proceed relatively unimpeded during the winter season. Additionally, this wall type has high lateral resistance that minimizes the use of ground anchors, which could be a significant benefit if numerous shafts conflict with existing utilities and structures. This wall type can be cantilevered up to 21 ft. without a surcharge load and up to 18 ft. with a surcharge load behind the wall.

The unit price for this wall ranges between $160 and $192 per square foot. Tiebacks will likely be required for walls higher than 18 ft. The unit price includes the price of tiebacks for exposed wall heights greater than 18 ft.

***Sheet Pile Wall:***

This "top-down" wall system can installed either by driving or vibrating interlocking steel sections. Z-shaped sections with ball and socket interlocking are the most common sections to resist bending stresses. Once the sheeting is installed, the soil in front of the wall is excavated and a final facing is constructed for aesthetic purposes.

The sheet pile will carry the full earth pressure and will partially cutoff groundwater by passing the wall through clay with low permeability. The wall is considered a partial cutoff wall, as seepage may occur between the interlocks.

The advantages of the sheet pile wall are similar to a secant pile wall. Tiebacks may be required for taller heights, as the sheet piles have less intrinsic lateral resistance capability than the secant pile walls with embedded reinforcement. Construction for sheet pile walls is also "top-down" meaning that lane closures are not required because construction equipment will be working uphill and behind the walls. Typically, a sheet pile wall can be cantilevered up to 16 ft. without a surcharge load behind the wall, and up to 12 ft. with a surcharge load applied behind the wall, depending on the ground conditions. Additional advantages to this wall type also include the speed and ease of installation in appropriate soil types, full height excavation after driving, and effectiveness in cutting off groundwater flow.

The unit price for this wall ranges between $140 and $175 per square foot. The price increases for taller wall heights because tiebacks will likely be required for walls greater than 12 ft. The unit price includes the price of tiebacks for exposed wall heights greater than 12 ft.

***Soil Mixed Wall:***

This "top-down" wall system is constructed in a similar staged manner to the secant and tangent pile wall; however, instead of drilled shafts, this wall consists of soil-cement mixed columns. The male columns are mixed in Stage 1 and then beams (which are typically W-Sections) are vibrated down into the soil-cement mixed column. In Stage 2, the female soil-mix columns will overlap the male columns. Once the soil-cement mix sets-up, the soil in front of the wall is excavated, and the facing is constructed for aesthetic purposes.

Typically, these walls can be cantilevered up to 18 ft. without surcharge load and up to 14 ft. assuming surcharge behind the wall. Unit prices for this type of wall are similar to Secant and Tangent Pile Walls, between $160 and $192 per square foot.

***Concrete Slurry Trench Wall:***

This "top-down" wall system is constructed by excavating the soil within the trench or wall width using slurry to maintain an open trench. On achieving the desired depth, concrete is then tremied from the bottom of the excavation under pressure, replacing the slurry. Steel rebar can then be vibrated into placement. Once the concrete cures, the soil in front of the wall is excavated, and the final facing is constructed for aesthetic purposes.

This concrete wall system will carry the full earth pressure and cut off the ground water, bypassing the wall through clay that has relatively low permeability. Typically, these walls can be cantilevered up to 21 ft. without surcharge load and up to 18 ft. assuming surcharge behind the wall. Advantages of this wall type are similar to the secant and tangent pile wall. This wall system can be constructed relatively unimpeded during the winter season. Additionally, this wall type has large lateral resistance that minimizes the use of ground anchors, which could be a significant benefit if numerous shafts conflict with existing utilities and structures. This wall system can also be designed around potential conflicts or utilities crossing through the wall. However, one disadvantage is that these walls are typically slower to construct and thus relatively costly.

The unit price for this wall ranges between $136 and $163 per square foot. Tiebacks will likely be required for wall heights greater than 18 ft. The unit price includes the price of tiebacks for exposed wall heights greater than 18 ft.

***Cantilevered Cast-in-Place Concrete (CIPC) Wall:***

The cantilevered CIPC wall is supported on either concrete footings or footings on piles. This is a conventional wall system that has been used for the existing retaining abutments and walls at this site. This wall system is constructed by first installing piles (if pile supported) and then forming and pouring the concrete footings, stem, and facing for the wall. After the concrete cures, a drainage system is installed within the granular backfill as it is placed behind the wall.

Advantages of this wall system include ease of construction, the versatility of this conventional design in a variety of subsurface conditions, and lower risks associated with this wall system. Disadvantages include a higher cost among fill wall types if on piles and the slower production rate compared to MSE walls. Deep foundations (piles) may also be required to support the CIPC walls where the lateral earth pressure is large enough to cause wall instability or induce settlement.

The unit price for this wall type ranges between $86 to $136 per square foot. For exposed wall heights of 15 ft. or greater, the wall is assumed to be supported on piles.

***Mechanically Stabilized Earth (MSE) Wall:***

MSE walls are earth retaining structures constructed by placing tensile reinforcing geotextiles, galvanized steel straps, or welded wire reinforcing mesh mats with variable lengths in granular fill soil. The mats, straps, or geotextiles are placed between successive layers of backfill. Wire-face mats are bent up at the front to form the face of the wall whereas the geotextiles and straps are connected to a facing system. The thickness of the compacted soil layers between reinforcing mats or geotextiles is typically 18 inches.

A facing system is often placed for aesthetic purposes and to prevent soil raveling between the reinforcing elements, allowing vertical or very steep slopes to be safely constructed.

The MSE wall system significantly improves the soil or backfill strength, such that the vertical face of the soil/reinforcement is essentially self-supported. Advantages of using the MSE wall system is that the construction can proceed rapidly and does not require large construction equipment. In addition, the MSE wall system is probably one of the most flexible retaining wall systems available because it can tolerate relatively large deformations without distress.

A minor disadvantage associated with this wall type consists of the potential for a relatively large footprint required to construct the wall to satisfy internal and external stability. The space behind the wall face required to construct the wall is at least 70 percent of the maximum exposed height. In addition, the MSE wall system may not be appropriate if there is groundwater above the excavation level or a potential for external stability failures. These external stability failures include rotational failure outside the soil reinforced mass or bearing capacity failure due to weak foundation soils. The length of the reinforcement can be extended deeper and longer to reduce the risks of rotational and bearing capacity failures; however, this increases its cost. Lengthening the reinforcement may also be necessary to reduce the distributed load on weak foundation soils where large settlements may be induced by the fill.

The unit prices for this wall range between $93 and $118 per square foot. Typical reinforcement lengths are estimated to be 70 percent of the exposed wall height with an embedment depth of 4 ft.

***Summary of Wall Costs:***

The following summarizes the approximate square foot costs for construction of the various retaining walls identified in this section.

- Post and Panel Wall
  $ 97 - $133/SF
- Secant and Tangent Pile Wall
  $160 - $192/SF
- Sheet Pile Wall
  $140 - $175/SF
- Soil Mixed Wall
  $160 - $192/SF
- Concrete Slurry Trench Wall
  $136 - $163/SF
- Cantilever Cast-in-Place Concrete Wall
  $ 86 - $136/SF
- Mechanically Stabilized Earth Wall
  $ 93 - $118/SF

These wall cost estimates are based on unit prices from MDOT's average unit prices for construction projects. If the heights require tiebacks, the upper end unit prices should be used. If the walls are typically short enough not to require the tiebacks, the lower end prices can be used for estimating costs.

The estimate of $60/SF for wall construction as listed in the cost data provided to the VE team is too low, and will not accurately reflect costs for construction anticipated to occur after 2008.

Temporary retaining walls for staging purposes will be required and are not included in the cost model. For the purposes of the cost analysis, such temporary retaining walls are considered to be part of the contingency factor.

## Review Total Area and Total Cost of Retaining Walls



The VE team recommends that a unit cost of $100/SF be used in the cost estimate for retaining walls based on 2004 dollars. The type of wall should be determined during the engineering design, but will most likely be cast-in-place concrete, based on previous project experience.

The total cost of the retaining wall provided to the VE team was $20.6 million. The cost is based on 40,969 lf. with an average height of 8.38 ft. and using a unit price of $60.00/sf. Exhibit P1.3 shows the breakdown of these costs.

The VE team estimated the total length of the retaining walls to be 40,250 lf. and an average height of 15 ft. (based on the use of aerials and contour mapping). Utilizing the same unit price of $60.00/SF the total cost of the walls will be $41.6 million as shown in Exhibit P1.4.

The unit price of $60.00/sf. was considered low by the VE team. A more conservative unit price may be $100.00/SF for a 2004 estimate. Exhibit P1.5 shows the total cost of the retaining walls to be $69.4 million, using the higher unit price of $100.00/sf. and the increased quantities calculated by the VE team.

Exhibits P1.6 and P1.7 show the impact of assuming a wall height of 20 ft. at both the $60.00/SF and $100.00/SF unit price. The wall height may increase from the 10 ft. or 15 ft. height if the wall is pushed back away from the shoulder and extends four feet above natural ground to become a pedestrian and vehicle restraint. The costs are $55.5 million and $92.5 million for 20-foot-high walls and $60/sf. and $100/sf. respectively.

### BASE ESTIMATE: WALL QUANTITIES AND COSTS

(from estimate provided to the VE team)

| **Section I (I-96 to M-10)** | | | | | |
|---|---|---|---|---|---|
| | **Length** | **Avg. Height** | **Area (sq.ft.)** | **Unit Cost** | **Cost** |
| Eastbound | 4,595 | 8.2 | 37,679 | $60.00 | $2,260,740.00 |
| Westbound | 3,980 | 8.6 | 34,228 | $60.00 | $2,053,680.00 |
| **Subtotal** | **8,575** | | **71,907** | | **$4,314,420.00** |
| | | | | | |
| **Section II (M-10 Interchange)** | | | | | |
| | **Length** | **Avg. Height** | **Area (sq.ft.)** | **Unit Cost** | **Cost** |
| Northbound | 2,083 | 9.5 | 19,789 | $60.00 | $1,187,310.00 |
| Southbound | 1,350 | 8 | 10,800 | $60.00 | $648,000.00 |
| I-94 | 664 | 10.5 | 6,972 | $60.00 | $418,320.00 |
| **Subtotal** | **4,097** | | **37,561** | | **$2,253,630.00** |
| | | | | | |
| **Section III (M-10 to I-75)** | | | | | |
| | **Length** | **Avg. Height** | **Area (sq.ft.)** | **Unit Cost** | **Cost** |
| Eastbound | 2,977 | 7.5 | 22,328 | $60.00 | $1,339,650.00 |
| Westbound | 2,190 | 8 | 17,520 | $60.00 | $1,051,200.00 |
| **Subtotal** | **5,167** | | **39,848** | | **$2,390,850.00** |
| | | | | | |
| **Section IV (I-75 Interchange)** | | | | | |
| | **Length** | **Avg. Height** | **Area (sq.ft.)** | **Unit Cost** | **Cost** |
| Northbound | 765 | 14.5 | 11,093 | $60.00 | $665,550.00 |
| Southbound | 818 | 13.5 | 11,043 | $60.00 | $662,580.00 |
| **Subtotal** | **1,583** | | **22,136** | | **$1,328,130.00** |
| | | | | | |
| **Section V (I-75 to Conner)** | | | | | |
| | **Length** | **Avg. Height** | **Area (sq.ft.)** | **Unit Cost** | **Cost** |
| Eastbound | 570 | 9.5 | 5,415 | $60.00 | $324,900.00 |
| Eastbound | 2344.6 | 6.8 | 15,943 | $60.00 | $956,596.80 |
| Eastbound | 3200 | 8.7 | 27,840 | $60.00 | $1,670,400.00 |
| Eastbound | 3820 | 8.1 | 30,942 | $60.00 | $1,856,520.00 |
| Westbound | 570 | 9.5 | 5,415 | $60.00 | $324,900.00 |
| Westbound | 4780 | 8 | 38,240 | $60.00 | $2,294,400.00 |
| Westbound | 2900 | 7 | 20,300 | $60.00 | $1,218,000.00 |
| Westbound | 3362 | 8.2 | 27,568 | $60.00 | $1,654,104.00 |
| **Subtotal** | **21,547** | | **171,664** | | **$10,299,820.80** |
| | | | | | |
| **Wall Total** | **40,969** | | **343,116** | | **$20,586,850.80** |

*Note: Costs are in 2002 dollars.*

*Exhibit P1.3*

## Review Total Area and Total Cost of Retaining Walls

**Proposal 1**



**Comparison No. 1: Retaining Wall Quantities and Costs**

Date: 3/18/2004

**VE Assumptions:** **Wall Height:** 15 $/sq. ft. **Unit Cost:** 60 $/sq. ft

| Location | Length Eastbound | Location | Length Westbound | Wall Height | Area (Sq. Ft.) EB | Area (Sq. Ft.) WB | Cost from EPE |
|---|---|---|---|---|---|---|---|
| **Section I** | | Linwood to 14th Street | | | | | |
| Linwood to 14th Street | 1,000 | Linwood to 14th Street | 0 | 15 | 15,000 | 0 | |
| 14th-Rosa Parks | 1,350 | 14th-Rosa Parks | 600 | 15 | 20,250 | 9,000 | |
| Rosa Parks-Trumbull | 1,350 | Rosa Parks-Trumbull | 1,400 | 15 | 20,250 | 21,000 | |
| | | | | | 55,500 | 30,000 | |
| | | | | | 3,330,000 | 1,800,000 | |
| **Section I Subtotal** | **3,700** | | **2,000** | | | **$5,130,000** | **$4,314,420** |
| **Section II** | | | | | | | |
| Trumbull-M-10 | 1,600 | Trumbull-M-10 | 800 | 15 | 24,000 | 12,000 | |
| I-94-Warren | 1,050 | I-94-Grand Trunk | 1,200 | 15 | 15,750 | 18,000 | |
| Forest-POB of M-10 | 0 | Grand Trunk- Baltimore | 400 | 15 | 0 | 6,000 | |
| Forest-POB of M-10 | 0 | | | 15 | 0 | | |
| POB of M10-Forest | 0 | | | 15 | 0 | | |
| Forest-Warren | 0 | Baltimore-Grand Trunk | 400 | 15 | 0 | 6,000 | |
| M-10-2nd Street | 600 | M10-2nd Street | 1,000 | 15 | 9,000 | 15,000 | |
| M-10-2nd St | 750 | M-10-2nd Street | 0 | 15 | 11,250 | 0 | |
| | | | | | 60,000 | 57,000 | |
| | | | | | 3,600,000 | 3,420,000 | |
| **Section II Subtotal** | **4,000** | | **3,800** | | | **$7,020,000** | **$2,253,630** |
| **Section III** | | | | | | | |
| 2nd-Cass | 600 | 2nd-Cass | 0 | 15 | 9,000 | 0 | |
| Cass-Woodward | 450 | Cass-Woodward | 0 | 15 | 6,750 | 0 | |
| Woodward-Brush | 0 | Woodward-Brush | 0 | 15 | 0 | 0 | |
| | | | | | 15,750 | 0 | |
| | | | | | $945,000 | $0 | |
| **Section III Subtotal** | **1,050** | | **0** | | | **$945,000** | **$2,390,850** |
| **Section IV** | | | | | | | |
| Brush-I-75 | 0 | Brush-I-75 | 1,600 | 15 | 0 | 24,000 | |
| I-94-Ferry | 0 | I-94-Milwaukee | 1,700 | 15 | 0 | 25,500 | |
| Ferry-I-94 | 1,200 | Milwaukee-I-94 | 0 | 15 | 18,000 | 0 | |
| I-75-St. Aubin | 2,400 | I-75-St. Aubin | 1,300 | 15 | 36,000 | 19,500 | |
| | | | | | 54,000 | 69,000 | |
| | | | | | $3,240,000 | $4,140,000 | |
| **Section IV Subtotal** | **3,600** | | **4,600** | | | **$7,380,000** | **$1,328,130** |
| **Section V** | | | | | | | |
| St. Aubin-Chene | 500 | St. Aubin-Chene | 0 | 15 | 7,500 | 0 | |
| Chene-East Grand Blvd. | 1,300 | Chene-East Grand Blvd | 0 | 15 | 19,500 | 0 | |
| East Grand Blvd-Mt. Elliott | 0 | East Grand Blvd-Mt. Elliott | 0 | 15 | 0 | 0 | |
| Mt. Elliott-Conrail | 850 | Mt. Elliott-Conrail | 950 | 15 | 12,750 | 14,250 | |
| Conrail-Concord | 1,200 | Conrail-Concord | 600 | 15 | 18,000 | 9,000 | |
| Concord-Frontenac | 1,050 | Concord-Frontenac | 1,100 | 15 | 15,750 | 16,500 | |
| Fontenac-Van Dyke | 1,700 | Fontenac-Van Dyke | 1,750 | 15 | 25,500 | 26,250 | |
| Van Dyke-Burns | 1,250 | Van Dyke-Burns | 2,100 | 15 | 18,750 | 31,500 | |
| Burns-Gratiot | 2,300 | Burns-Gratiot | 2,000 | 15 | 34,500 | 30,000 | |
| Gratiot-Cadillac | 650 | Gratiot-Cadillac | 500 | 15 | 9,750 | 7,500 | |
| Cadillac-French | 400 | Cadillac-French | 600 | 15 | 6,000 | 9,000 | |
| French-Conrail | 1,150 | French-Conrail | 600 | 15 | 17,250 | 9,000 | |
| Conrail-Conner | 500 | Conrail-Conner | 450 | 15 | 7,500 | 6,750 | |
| Conner-Barrett | 0 | Conner-Barrett | 0 | 15 | 0 | 0 | |
| | | | | | 192,750 | 159,750 | |
| | | | | | $11,565,000 | $9,585,000 | |
| **Section V Subtotal** | **12,880** | | **10,650** | | | **$21,150,000** | **$10,299,820** |
| **Total** | **25,200** | | **21,050** | | **693,750** | **$41,625,000** | **$20,586,850** |

*Note: Revised VE quantities, but same unit price as base estimate*

*Exhibit P1.4*

**Comparison No. 2: Retaining Wall Quantities and Costs**

Date: 3/18/2004

**VE Assumptions:** **Wall Height:** 15 Ft. Average **Unit Cost:** 100 $/sq. ft.

| Location | Length Eastbound | Location | Length Westbound | Wall Height | Area (Sq. Ft.) EB | Area (Sq. Ft.) WB | Cost from EPE |
|---|---|---|---|---|---|---|---|
| **Section I** | | | | | | | |
| **Linwood to 14th St** | 1,000 | Linwood to 14th Street | 0 | 15 | 15,000 | 0 | |
| Linwood to 14th Street | 1,350 | Linwood to 14th Street | 600 | 15 | 20,250 | 9,000 | |
| Rosa Parks-Trumbull | 1,350 | Rosa Parks-Trumbull | 1,400 | 15 | 20,250 | 21,000 | |
| | | | | | 55,500 | 30,000 | |
| | | | | | $5,550,000 | $3,000,000 | |
| **Section I Subtotal** | **3,700** | | **2,000** | | | **$8,550,000** | **$4,314,420** |
| **Section II** | | | | | | | |
| Trumbull-M10 | 1,600 | Trumbull-M10 | 800 | 15 | 24,000 | 12,000 | |
| Trumbull-M-10 | 1,050 | Trumbull-M-10 | 1,200 | 15 | 15,750 | 18,000 | |
| Warren-Forest | 0 | Grand Trunk- Baltimore | 400 | 15 | 0 | 6,000 | |
| Forest-POB of M-10 | 0 | | | 15 | 0 | | |
| Forest-POB of M-10 | 0 | | | 15 | 0 | | |
| Forest-Warren | 0 | Baltimore-Grand Trunk | 400 | 15 | 0 | 6,000 | |
| Warren-I-94 | 600 | Grand Trunk-I-94 | 1,000 | 15 | 9,000 | 15,000 | |
| M-10-2nd Street | 750 | M10-2nd Street | 0 | 15 | 11,250 | 0 | |
| M-10-2nd St | | M-10-2nd Street | | | 60,000 | 57,000 | |
| | | | | | $6,000,000 | $5,700,000 | |
| **Section II Subtotal** | **4,000** | | **3,800** | | | **$11,700,000** | **$2,253,630** |
| **Section III** | | | | | | | |
| 2nd-Cass | 600 | 2nd-Cass | 0 | 15 | 9,000 | 0 | |
| Cass-Woodward | 450 | Cass-Woodward | 0 | 15 | 6,750 | 0 | |
| Woodward-Brush | 0 | Woodward-Brush | 0 | 15 | 0 | 0 | |
| | | | | | 15,750 | 0 | |
| | | | | | $1,575,000 | $0 | |
| **Section III Subtotal** | **1,050** | | **0** | | | **$1,575,000** | **$2,390,850** |
| **Section IV** | | | | | | | |
| **Brush-I-75** | 0 | Brush-I-75 | 1,600 | 15 | 0 | 24,000 | |
| I-94-Ferry | 0 | I-94-Milwaukee | 1,700 | 15 | 0 | 25,500 | |
| Ferry-I-94 | 1,200 | Milwaukee-I-94 | 0 | 15 | 18,000 | 0 | |
| I-75-St. Aubin | 2,400 | I-75-St. Aubin | 1,300 | 15 | 36,000 | 19,500 | |
| | | | | | 54,000 | 69,000 | |
| | | | | | $5,400,000 | $6,900,000 | |
| **Section IV Subtotal** | **3,600** | | **4,600** | | | **$12,300,000** | **$1,328,130** |
| **Section V** | | | | | | | |
| St. Aubin-Chene | 500 | St. Aubin-Chene | 0 | 15 | 7,500 | 0 | |
| Chene-East Grand Blvd. | 1,300 | Chene-East Grand Blvd. | 0 | 15 | 19,500 | | |
| Chene-East Grand Blvd. | 0 | East Grand Blvd-Mt. Elliott | 0 | 15 | 0 | 0 | |
| Mt. Elliott-Conrail | 850 | Mt. Elliott-Conrail | 950 | 15 | 12,750 | 14,250 | |
| Conrail-Concord | 1,200 | Conrail-Concord | 600 | 15 | 18,000 | 9,000 | |
| Concord-Frontenac | 1,050 | Concord-Frontenac | 1,100 | 15 | 15,750 | 16,500 | |
| Fontenac-Van Dyke | 1,700 | Fontenac-Van Dyke | 1,750 | 15 | 25,500 | 26,250 | |
| Van Dyke-Burns | 1,250 | Van Dyke-Burns | 2,100 | 15 | 18,750 | 31,500 | |
| Burns-Gratiot | 2,300 | Burns-Gratiot | 2,000 | 15 | 34,500 | 30,000 | |
| Gratiot-Cadillac | 650 | Gratiot-Cadillac | 500 | 15 | 9,750 | 7,500 | |
| Cadillac-French | 400 | Cadillac-French | 600 | 15 | 6,000 | 9,000 | |
| French-Conrail | 1,150 | French-Conrail | 600 | 15 | 17,250 | 9,000 | |
| Conrail-Conner | 500 | Conrail-Conner | 450 | 15 | 7,500 | 6,750 | |
| Conner-Barrett | 0 | Conner-Barrett | 0 | 15 | 0 | 0 | |
| | | | | | 192,750 | 159,750 | |
| | | | | | $19,275,000 | $15,975,000 | |
| **Section V Subtotal** | **12,850** | | **10,650** | | | **$35,250,000** | **$10,299,820** |
| **Total** | **25,200** | | **21,050** | | **693,750** | **$69,375,000** | **$20,586,850** |

*Note: Revised VE quantities, but higher unit price*

*Exhibit P1.5*

## Review Total Area and Total Cost of Retaining Walls

**Proposal 1**

**6 of 7**

**Comparison No. 3: Retaining Wall Quantities and Costs**

Date: 3/18/2004

**VE Assumptions:** **Wall Height:** **20** **Ft. Average** **Unit Cost:** **60** **$/sq. ft.**

| Location | Length Eastbound | Location | Length Westbound | Wall Height | Area (Sq. Ft.) EB | Area (Sq. Ft.) WB | Cost from EPE |
|---|---|---|---|---|---|---|---|
| **Section I** | | | | | | | |
| **Linwood to 14th St** | 1,000 | Linwood to 14th Street | 0 | 20 | 20,000 | 0 | |
| Linwood to 14th Street | 1,350 | Linwood to 14th Street | 600 | 20 | 27,000 | 12,000 | |
| Rosa Parks-Trumbull | 1,350 | Rosa Parks-Trumbull | 1,400 | 20 | 27,000 | 28,000 | |
| | | | | | 74,000 | 40,000 | |
| | | | | | $4,440,000 | $2,400,000 | |
| **Section I Subtotal** | **3,700** | | **2,000** | | | **$6,840,000** | **$4,314,420** |
| **Section II** | | | | | | | |
| Trumbull-M10 | 1,600 | Trumbull-M10 | 800 | 20 | 32,000 | 16,000 | |
| Trumbull-M-10 | 1,050 | Trumbull-M-10 | 1,200 | 20 | 21,000 | 24,000 | |
| Warren-Forest | 0 | Grand Trunk- Baltimore | 400 | 20 | 0 | 8,000 | |
| Forest-POB of M-10 | 0 | | | 20 | 0 | | |
| Forest-POB of M-10 | 0 | | | 20 | 0 | | |
| Forest-Warren | 0 | Baltimore-Grand Trunk | 400 | 20 | 0 | 8,000 | |
| Warren-I-94 | 600 | Grand Trunk-I-94 | 1,000 | 20 | 12,000 | 20,000 | |
| M-10-2nd Street | 750 | M10-2nd Street | 0 | 20 | 15,000 | 0 | |
| M-10-2nd St | | M-10-2nd Street | | | 80,000 | 76,000 | |
| | | | | | $4,800,000 | $4,560,000 | |
| **Section II Subtotal** | **4,000** | | **3,800** | | | **$9,360,000** | **$2,253,630** |
| **Section III** | | | | | | | |
| 2nd-Cass | 600 | 2nd-Cass | 0 | 20 | 12,000 | 0 | |
| Cass-Woodward | 450 | Cass-Woodward | 0 | 20 | 9,000 | 0 | |
| Woodward-Brush | 0 | Woodward-Brush | 0 | 20 | 0 | 0 | |
| | | | | | 21,000 | 0 | |
| | | | | | $1,260,000 | $0 | |
| **Section III Subtotal** | **1,050** | | **0** | | | **$1,260,000** | **$2,390,850** |
| **Section IV** | | | | | | | |
| **Brush-I-75** | 0 | Brush-I-75 | 1,600 | 15 | 0 | 24,000 | |
| I-94-Ferry | 0 | I-94-Milwaukee | 1,700 | 20 | 0 | 34,000 | |
| Ferry-I-94 | 1,200 | Milwaukee-I-94 | 0 | 20 | 24,000 | 0 | |
| I-75-St. Aubin | 2,400 | I-75-St. Aubin | 1,300 | 20 | 48,000 | 26,000 | |
| | | | | | 72,000 | 92,000 | |
| | | | | | $4,320,000 | $5,520,000 | |
| **Section IV Subtotal** | **3,600** | | **4,600** | | | **$9,840,000** | **$1,328,130** |
| **Section V** | | | | | | | |
| St. Aubin-Chene | 500 | St. Aubin-Chene | 0 | 20 | 10,000 | 0 | |
| Chene-East Grand Blvd. | 1,300 | Chene-East Grand Blvd. | 0 | 20 | 26,000 | 0 | |
| Chene-East Grand Blvd. | 0 | East Grand Blvd-Mt. Elliott | 0 | 20 | 0 | 0 | |
| Mt. Elliott-Conrail | 850 | Mt. Elliott-Conrail | 950 | 20 | 17,000 | 19,000 | |
| Conrail-Concord | 1,200 | Conrail-Concord | 600 | 20 | 24,000 | 12,000 | |
| Concord-Frontenac | 1,050 | Concord-Frontenac | 1,100 | 20 | 21,000 | 22,000 | |
| Fontenac-Van Dyke | 1,700 | Fontenac-Van Dyke | 1,750 | 20 | 34,000 | 35,000 | |
| Van Dyke-Burns | 1,250 | Van Dyke-Burns | 2,100 | 20 | 25,000 | 42,000 | |
| Burns-Gratiot | 2,300 | Burns-Gratiot | 2,000 | 20 | 46,000 | 40,000 | |
| Gratiot-Cadillac | 650 | Gratiot-Cadillac | 500 | 20 | 13,000 | 10,000 | |
| Cadillac-French | 400 | Cadillac-French | 600 | 20 | 8,000 | 12,000 | |
| French-Conrail | 1,150 | French-Conrail | 600 | 20 | 23,000 | 12,000 | |
| Conrail-Conner | 500 | Conrail-Conner | 450 | 20 | 10,000 | 9,000 | |
| Conner-Barrett | 0 | Conner-Barrett | 0 | 20 | 0 | 0 | |
| | | | | | 257,000 | 213,000 | |
| | | | | | $15,420,000 | $12,780,000 | |
| **Section V Subtotal** | **12,850** | | **10,650** | | | **$28,200,000** | **$10,299,820** |
| **Total** | **25,200** | | **21,050** | | **925,000** | **$55,500,000** | **$20,586,850** |

*Note: Revised VE quantities, same unit price as base estimate but increased height*

*Exhibit P1.6*

**Comparison No. 4: Retaining Wall Quantities and Costs**

Date: 3/18/2004

**VE Assumptions:** **Wall Height:** **20** **Ft. Average** **Unit Cost:** **100** **$/sq. ft.**

| Location | Length Eastbound | Location | Length Westbound | Wall Height | Area (Sq. Ft.) EB | Area (Sq. Ft.) WB | Cost from EPE |
|---|---|---|---|---|---|---|---|
| **Section I** | | | | | | | |
| **Linwood to 14th St** | 1,000 | Linwood to 14th Street | 0 | 20 | 20,000 | 0 | |
| Linwood to 14th Street | 1,350 | Linwood to 14th Street | 600 | 20 | 27,000 | 12,000 | |
| Rosa Parks-Trumbull | 1,350 | Rosa Parks-Trumbull | 1,400 | 20 | 27,000 | 28,000 | |
| | | | | | 74,000 | 40,000 | |
| | | | | | $7,400,000 | $4,000,000 | |
| **Section I Subtotal** | **3,700** | | **2,000** | | | **$11,400,000** | **$4,314,420** |
| **Section II** | | | | | | | |
| Trumbull-M10 | 1,600 | Trumbull-M10 | 800 | 20 | 32,000 | 16,000 | |
| Trumbull-M-10 | 1,050 | Trumbull-M-10 | 1,200 | 20 | 21,000 | 24,000 | |
| Warren-Forest | 0 | Grand Trunk- Baltimore | 400 | 20 | 0 | 8,000 | |
| Forest-POB of M-10 | 0 | | | 20 | 0 | | |
| Forest-POB of M-10 | 0 | | | 20 | 0 | | |
| Forest-Warren | 0 | Baltimore-Grand Trunk | 400 | 20 | 0 | 8,000 | |
| Warren-I-94 | 600 | Grand Trunk-I-94 | 1,000 | 20 | 12,000 | 20,000 | |
| M-10-2nd Street | 750 | M10-2nd Street | 0 | 20 | 15,000 | 0 | |
| M-10-2nd St | | M-10-2nd Street | | | 80,000 | 76,000 | |
| | | | | | $8,000,000 | $7,600,000 | |
| **Section II Subtotal** | **4,000** | | **3,800** | | | **$15,600,000** | **$2,253,630** |
| **Section III** | | | | | | | |
| 2nd-Cass | 600 | 2nd-Cass | 0 | 20 | 12,000 | 0 | |
| Cass-Woodward | 450 | Cass-Woodward | 0 | 20 | 9,000 | 0 | |
| Woodward-Brush | 0 | Woodward-Brush | 0 | 20 | 0 | 0 | |
| | | | | | 21,000 | 0 | |
| | | | | | $2,100,000 | $0 | |
| **Section III Subtotal** | **1,050** | | **0** | | | **$2,100,000** | **$2,390,850** |
| **Section IV** | | | | | | | |
| **Brush-I-75** | 0 | Brush-I-75 | 1,600 | 15 | 0 | 24,000 | |
| I-94-Ferry | 0 | I-94-Milwaukee | 1,700 | 20 | 0 | 34,000 | |
| Ferry-I-94 | 1,200 | Milwaukee-I-94 | 0 | 20 | 24,000 | 0 | |
| I-75-St. Aubin | 2,400 | I-75-St. Aubin | 1,300 | 20 | 48,000 | 26,000 | |
| | | | | | 72,000 | 84,000 | |
| | | | | | $7,200,000 | $8,400,000 | |
| **Section IV Subtotal** | **3,600** | | **4,600** | | | **$15,600,000** | **$1,328,130** |
| **Section V** | | | | | | | |
| St. Aubin-Chene | 500 | St. Aubin-Chene | 0 | 20 | 10,000 | 0 | |
| Chene-East Grand Blvd. | 1,300 | Chene-East Grand Blvd. | 0 | 20 | 26,000 | 0 | |
| Chene-East Grand Blvd. | 0 | East Grand Blvd-Mt. Elliott | 0 | 20 | 0 | 0 | |
| Mt. Elliott-Conrail | 850 | Mt. Elliott-Conrail | 950 | 20 | 17,000 | 19,000 | |
| Conrail-Concord | 1,200 | Conrail-Concord | 600 | 20 | 24,000 | 12,000 | |
| Concord-Frontenac | 1,050 | Concord-Frontenac | 1,100 | 20 | 21,000 | 22,000 | |
| Fontenac-Van Dyke | 1,700 | Fontenac-Van Dyke | 1,750 | 20 | 34,000 | 35,000 | |
| Van Dyke-Burns | 1,250 | Van Dyke-Burns | 2,100 | 20 | 25,000 | 42,000 | |
| Burns-Gratiot | 2,300 | Burns-Gratiot | 2,000 | 20 | 46,000 | 40,000 | |
| Gratiot-Cadillac | 650 | Gratiot-Cadillac | 500 | 20 | 13,000 | 10,000 | |
| Cadillac-French | 400 | Cadillac-French | 600 | 20 | 8,000 | 12,000 | |
| French-Conrail | 1,150 | French-Conrail | 600 | 20 | 23,000 | 12,000 | |
| Conrail-Conner | 500 | Conrail-Conner | 450 | 20 | 10,000 | 9,000 | |
| Conner-Barrett | 0 | Conner-Barrett | 0 | 20 | 0 | 0 | |
| | | | | | 257,000 | 213,000 | |
| | | | | | $25,700,000 | $21,300,000 | |
| **Section V Subtotal** | **12,850** | | **10,650** | | | **$47,000,000** | **$10,299,820** |
| **Total** | **25,200** | | **21,050** | | **925,000** | **$92,500,000** | **$20,586,850** |

*Note: Revised VE quantities, higher unit price and increased height*

*Exhibit P1.7*

| **Review Total Area and Total Cost of Retaining Walls** | **Proposal 1**<br>**7 of 7** |
|---|---|

The cost estimate for the retaining walls has been summarized in the following manner. The cost of the retaining walls as provided to the VE team is $20.6 million which is used as the base cost. The cost for the increased quantity and wall heights are added to the base cost is shown below.

| | |
|---|---|
| **Base Cost** | **$20,587,000** |
| Allowance:<br>Due to quantity changes for a 15' high walls and a unit price of $60.00/SF. | $21,038,000 |
| Contingency:<br>For the revised quantity for 15' high walls and a unit price of $100.00/SF. | $27,750,000 |
| Reserve:<br>For the revised quantity for 20' high walls and a unit price of $100.00/SF. | $23,125,000 |
| Total Maximum Cost | $92,500,000 |

## Use Perimeter Road System for the Service Drives for both M-10 and I-75 Interchanges

Proposal 2

1 of 2

**DESCRIPTION:**

This proposal provides for the removal of service drives, and their associated bridges, within the core of the M-10 and I-75 system interchanges. The idea is based on the assumption that the remaining perimeter service drive system, in combination with u-turning roadways, provides for sufficient local access.

**EXISTING CONDITION:**

The M-10 and I-75 interchanges are over 40 years old and are at or beyond their functional and structural service life. The M-10 interchange includes substantial left-side exits and entrances, leading to excessive lane changing and congestion. The I-75 interchange includes all right-side exits and entrances. Both interchanges include non-standard geometric features and non-standard ramp spacing.

Currently, there are no service drives within the immediate vicinity of the system interchanges. There are a few service drives parallel to segments of the mainline roadways. They include:

- Along EB I-94, west of M-10
- Along SB M-10, south of I-94
- Along NB M-10, south of I-94
- Along SB M-10, north of I-94
- Along EB I-94, east of I-75
- Along SB I-75, south of I-94

**AS DESIGNED:**

Both system interchanges will be reconstructed to accommodate lane additions to I-94, to accommodate enhanced ramp designs for better geometrics and traffic operations, to accommodate revised service ramp connections at adjacent neighborhood areas, and to accommodate a continuous service drive system. Additionally, the M-10 interchange will be reconstructed to accommodate right side exits and entrances. The original proposal (Modification 1), as illustrated in the DEIS, January 2001, includes a continuous and parallel service drive system. An exception was that the original design did not provide for service drives through the system interchanges in the north-south directions.

Subsequent to the DEIS, but prior to the Recommended Alternatives Analysis Final Report, August 2002, the design was modified to include continuous and parallel service drives through both system interchanges, including east-west and north-south directions.

According to the DEIS, service drives are an integral part of the proposed design for several reasons:

- They provide direct access to adjacent residences, businesses, and institutions.
- Service drives provide "drive-by" traffic and greater opportunities for local businesses.
- Service drives separate local and through trips. This reduces local trips on the freeway, with less congestion and weaving along the mainline.
- Service drives provide alternate bypass routes during traffic incidents and short-term maintenance on the mainline.
- With flush shoulders and sidewalks (and presumed fencing), bicyclist and pedestrian access is provided along the service drives as they snake through and across system interchanges, removing existing barriers.
- Service drives have the potential to improve the transit service along the mainline, with greater efficiency and reliability.

**VE PROPOSAL:**

The VE proposal would keep all aspects of the "As-Designed" Proposal except for the removal of the service drives within the system interchange cores (at M-10 and I-75).

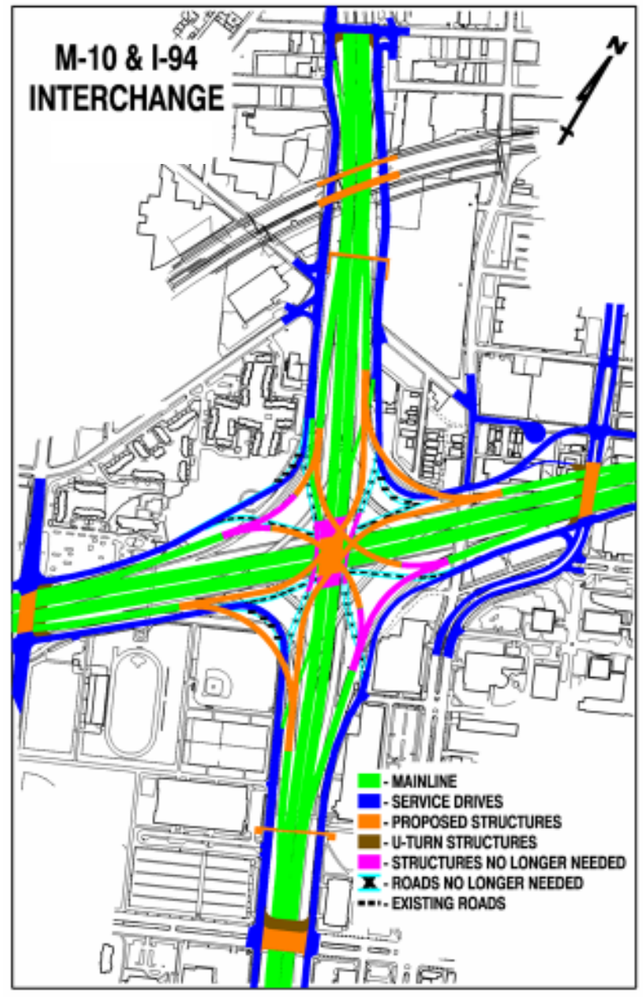



*Exhibit P2.1*

Advantages of the proposal include a substantial cost savings since less roadways and bridges would be constructed. Since interchanges would be less complex without these interwoven roadways and bridges, there would be greater potential for the interchange designs being able to meet minimum or desired design standards. Additionally, construction sequencing and maintenance of traffic considerations will be more simple. There is a greater amount of travel for motorists desiring to drive to the other side of a system interchange; however, this indirection is minor. To reduce travel times on the perimeter service drives, it is proposed to add U-turn roadways and/or bridges at the next available grade-separation. Typically, the "next" grade separated crossing is only 1/3 mile from the middle of the interchange core. As such, the travel indirection is minor. Therefore, the VE Proposal is still considered to possess all of the advantages that the continuous service drives provide, except to a slightly less degree.

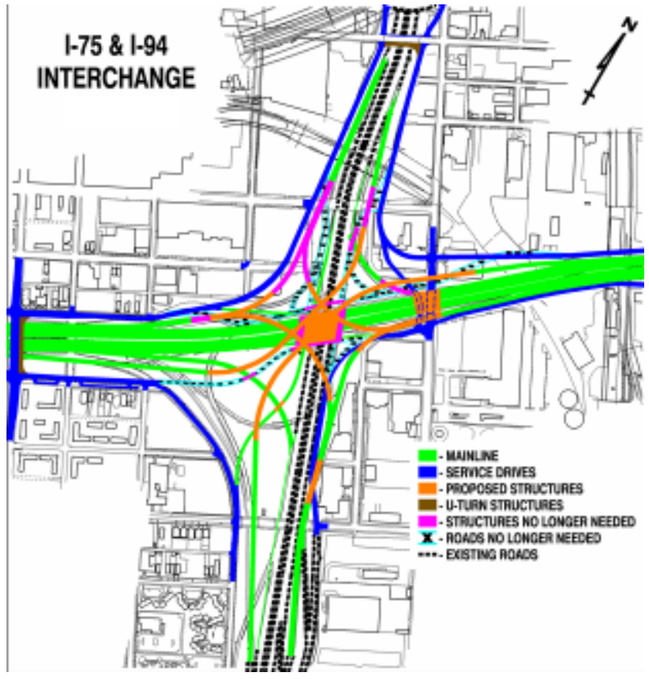



*Exhibit P2.1*

**OBJECTIVE AND RECOMMENDATION:**

The objective of the VE Proposal is to save project costs, yet maintain all or most of the benefits that a complete service drive system can offer. It is recommended that the VE Proposal be implemented.

**NET COST SAVINGS:**

Removing the service drives within the interchange core will save construction costs. Most of the cost savings are found with the elimination or narrowing of service drive bridges over the mainline, or by shortening the mainline or system ramp bridges since they no longer need to span the service drives. These cost savings are estimated to be $11.0 million at the M-10 interchange and $11.7 million at the I-75 interchange.

New u-turn structures or roadways are proposed to mitigate travel times around the interchanges. New retaining walls and earthen embankments are required in some areas to replace bridges. These cost additions are estimated to be $3.8 million at the M-10 interchange and $3.2 million at the I-75 interchange.

With considerations for utilities, contingencies, traffic control, design, and construction management costs the net savings to the project are estimated to be $10.3 million at the M-10 interchange and $12.1 million at the I-75 interchange, for a total cost savings of $22.4 million.

| First Cost | | | |
|---|---|---|---|
| **Item** | **As Designed** | **VE Proposal** | **Cost Difference** |
| M-10 Interchange | | | $10,300,000 |
| I-75 Interchange | | | $12,100,000 |

## Shift Eastbound Service Road at Mt. Elliot

Proposal 3

1 of 2

### EXISTING CONDITIONS:

The existing I-94 is constrained by the historic Packard Building on the south side of I-94. There is a retaining wall located at the northern right-of-way line adjacent to the Packard Building to eliminate impacts to the site. The retaining wall allows room for a driveway that provides access to the back side of the Packard Building.

Currently, there is no eastbound service drive between Mt. Elliot and Concord Avenue. Instead, the service drive crosses I-94 to the north side creating a two-way service drive which diverges from I-94 as Harper Road near Frontenac Road. After this point, a one directional service drive resumes, creating discontinuity along the westbound service drive.


*Exhibit P3.1*

### AS DESIGNED:

The proposed design shifts the I-94 mainline to the north to provide room for a service drive between the mainline and the historic Packard Building site. The environmental documents indicate that there is a potential for the closure of the intersection at Sherwood Avenue and the north service drive.

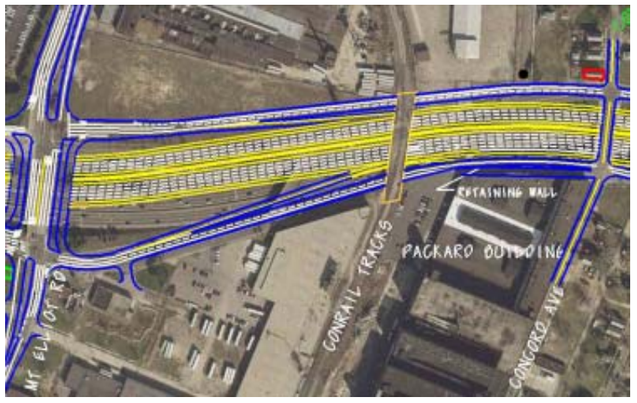



*Exhibit P3.2*
*As Designed*

### VE PROPOSAL:

This VE proposal is more a validation of the geometry to ensure no impacts to the historic Packard Building and that adequate vertical clearance will exist at the Conrail RR crossing. Using the low level U.S. Customary Units mapping which appears adequate for final design, the existing retaining wall, located adjacent to the historic Packard Building, was identified as a constraint. This was done to avoid any unnecessary impacts to the Packard Building or the driveway and retaining wall. For ease of construction, horizontal geometry was refined to better utilize the existing service road and cross streets while providing for the proposed design speeds. A profile was developed for both the I-94 mainline and the eastbound service drive to verify that the service drives could be built with intersections at both Mt. Elliot and Concord Avenue while passing beneath the Conrail tracks. The westbound service drive will have a profile identical to the one developed for the eastbound service drive but isn't shown as the horizontal constraints are not as great. The profile will need to be refined further in the engineering report to work with the entire corridor alignment and to set the correct stationing to the I-94 historic centerline stationing.

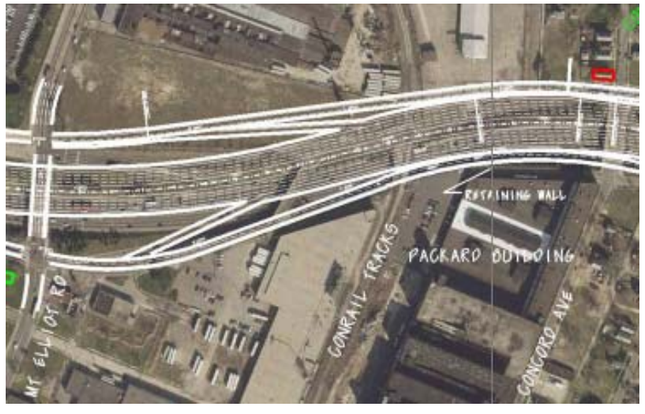



*Exhibit P3.3*
*VE Proposal*

| Shift Eastbound Service Road at Mt. Elliot | Proposal 3<br>2 of 2 |
|---|---|

The conclusion is that the geometry of all movements can be accommodated assuming an eight foot deep railroad structure. Further design refinements during the engineering report phase may further reduce the overall amount of retaining wall required while eliminating impacts to the existing wall. The pavement elevations will also be further refined to minimize the overall lowering of I-94 in this area. The service drive curves were designed using a 25 mph design speed but the values were above the minimum K values to provide for rider comfort.

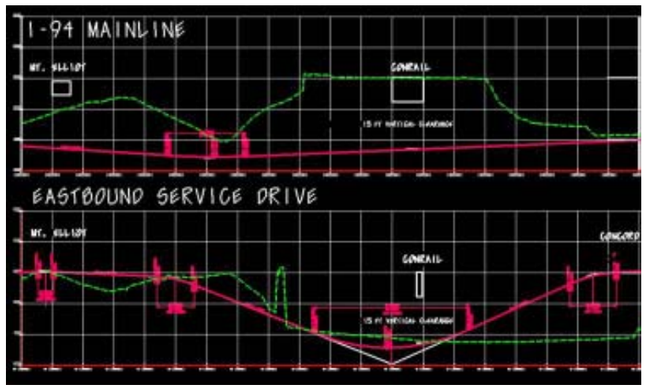



*Exhibit P3.4*
*VE Profiles*

**EVALUATION:**

The geometry is satisfied for all movements. The Sherwood Road intersection will be either closed or a portion of Sherwood Avenue will be reconstructed to lower the roadway. This is a design refinement that is recommended to be considered during the next phase.

There are no additional costs associated with this proposal. The existing wall adjacent to the Packard Building site will need to be checked for structural adequacy.

## Eliminate Traffic Signals at Certain Intersections



**EXISTING CONDITION:**

The existing I-94 corridor from I-96 to Conner does not currently have continuous service drives. Therefore, existing traffic signal locations on the service drives is not relevant for the purpose of this proposal.

**AS DESIGNED:**

The I-94 recommended alternative and associated Traffic Report, Volume 3 documents the necessity for 61 traffic signals along the continuous service drives. The cost estimate details that the project will require 52 new/upgraded traffic signals in association with this project.

The cost of the 52 signals at $100,000 per signal is $5,200,000.

**VE PROPOSAL:**

Based on the 2025 AM/PM traffic volumes provided in the "Traffic Report, Volume 3, Simulation of 2025 Conditions" some of the signals may not be warranted.

There are seven proposed traffic signals at local road intersections with either low through volumes or low turning volumes. In addition five intersections have one-way crossroads. The signals can be replaced with stop signs for the 12 intersections. The intersections are summarized as follows:

***Low Volume***

- WB I-94 Service Drive and Beaubien
- EB I-94 Service Drive and Beaubien
- EB I-94 Service Drive and Lucky
- EB I-94 Service Drive and Concord
- WB I-94 Service Drive and Concord
- SB I-75 Service Drive and Ferry
- NB I-75 Service Drive and Ferry

***One-way Crossroads***

- EB I-94 Service Drive and Rosa Parks
- WB I-94 Service Drive and Rosa Parks
- WB I-94 Service Drive and 3rd Street
- WB I-94 Service Drive and John R
- EB I-94 Service Road and John R

The cost of the VE Team's proposal would be

- 40 signals at $100,000 per signal = $4,000,000

| First Cost | | | |
|---|---|---|---|
| Item | As Designed | VE Proposal | Cost Difference |
| Traffic Signals | $5,200,000 | $4,000,000 | $1,200,000 |

**Use 12-ft. Median Shoulder for I-94 Mainline Instead of 14 Ft.** | **Proposal 5** | **1 of 1**

**EXISTING CONDITION:**

I-94 from I-96 to Conner Avenue has a median width of approximately 10'-4". The narrow median has an existing concrete median barrier (2'-4") which separates EB and WB with existing 4'-0" median shoulders.

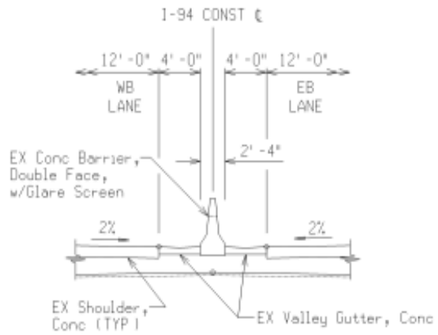



*Exhibit P5.1*

DETAIL OF EXISTING MEDIAN EB & WB I-94

**AS DESIGNED:**

The current DEIS exhibits illustrate, and the design criteria call for a 14'-0" shoulder (12 ft. plus 2 ft. shy distance). Within the 14 ft. shoulder there will be a 4'-0" valley gutter. EB and WB I-94 will be separately by a 6'-0" concrete median barrier.

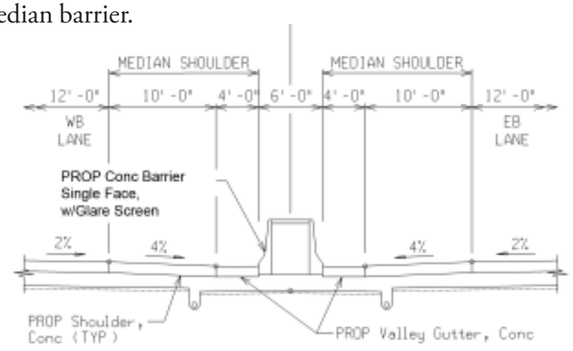



*Exhibit P5.2*

DETAIL OF AS DESIGNED MEDIAN EB & WB I-94

The total length of the project assumed for this proposal is 37,000 sf., which is based on the total concrete barrier length of 150,000 lft. in the DEIS cost estimate. This length is for four runs of barrier, two in the median and one on each outside shoulder. The cost of constructing a 14'-0" median shoulder is as follows:

| | |
|---|---|
| Shoulder: | |
| 2 x 37,500 ft. x 10 ft. x $3.40/sft. | $ 2,550,000 |
| Valley Gutter: | |
| 2 x 37,500 ft. x $7.65/ft. = | $ 573,750 |
| | $ 3,123,750 |

**VE PROPOSAL:**

As per MDOT/AASHTO standards for a four-lane freeway section, the required median shoulder width is 12 ft. due to the high truck volume. The proposal is to construct the 12'-0" median shoulder. The 12'-0" median shoulder would be an 8'-0" shoulder and a 4'-0" valley gutter. The cost of the VE proposal is:

| | |
|---|---|
| Shoulder: | |
| 2 x 37,500 ft. x 8 ft. x $3.40/sft. = | $2,040,000 |
| Valley Gutter: | |
| 2 x 37,500 ft. x $7.65/ft. = | $ 573,750 |
| | $2,613,750 |

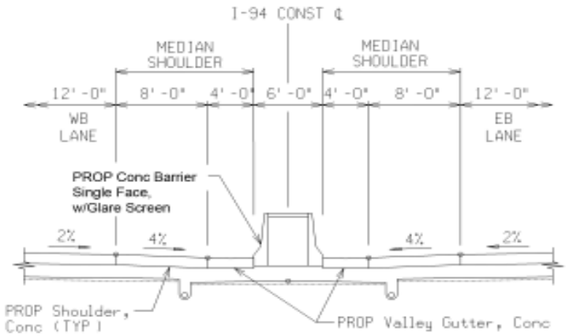



*Exhibit P5.3*

DETAIL OF PROPOSED MEDIAN EB & WB I-94

Additional savings are achieved in the structures, which will have shorter spans. Those savings are $1,498,000.

| First Cost | | | |
|---|---|---|---|
| **Item** | **As Designed** | **VE Proposal** | **Cost Difference** |
| Roadway | $3,123,750 | $2,613,750 | $510,000 |
| Bridge | - | | $1,498,000 |
| | | | $2,008,000 |

## Use 4-ft. Median Barrier for I-94 Mainline



**EXISTING CONDITION:**

I-94 from I-96 to Conner Avenue has a standard median barrier (2'-4" wide) and tapers out as required at the median bridge piers and signs.

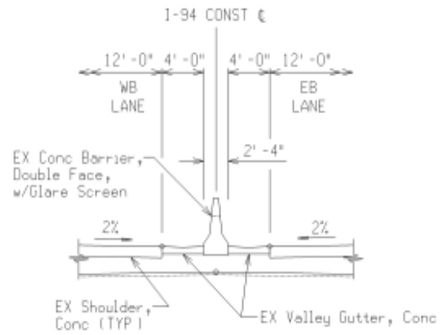



*Exhibit P6.1*

DETAIL OF EXISTING MEDIAN EB & WB I-94

**AS DESIGNED:**

The current DEIS calls for a 6'-0" split median barrier with 14'-0" median shoulders.

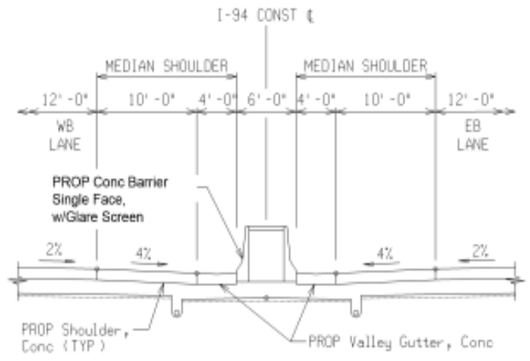



*Exhibit P6.2*

DETAIL OF AS DESIGNED MEDIAN EB & WB I-94

The total length of the project assumed for this proposal is 37,000 sf., which is based on the total concrete barrier length of 150,000 lft. in the DEIS cost estimate. This length is for four runs of barrier, two in the median and one on each outside shoulder. The cost of constructing a 6'-0" wide split median barrier with two single face barriers, including the paved surface between the barriers, fill and subbase is:

2 x 37,500 ft. x $90.00/ft. = $ 6,750,000

**VE PROPOSAL:**

Place a 4'-0" wide median barrier and 14'-0" shoulders the entire project length. This will provide a consistent median width and the 4'-0" barrier would be wide enough to accommodate the center bridge piers without having to taper in and out. The cost of this VE Proposal is as follows:

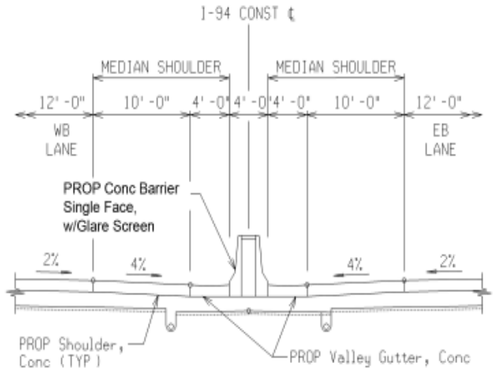



*Exhibit P6.3*

Assume 15% reduction in Phase I unit price for concrete barrier to account for narrower paved surface, less fill and less subbase.

$90/ft. x .85 = $76.50/ft.
2 x 37,500 ft. x $76.50/ft. = $ 5,737,500

Additional savings are achieved in the structures, which will have shorter spans. Those savings are $749,000.

| First Cost | | | |
|---|---|---|---|
| **Item** | **As Designed** | **VE Proposal** | **Cost Difference** |
| Roadway | $6,750,000 | $5,737,500 | $1,012,250 |
| Bridge | - | | $ 749,000 |
| | | | $1,761,500 |

| Place Valley Gutter or Curb in Front of the Retaining Wall Instead of Single Face Barrier | Proposal 7<br>1 of 1 |
|---|---|

**EXISTING CONDITION:**

I-94 from I-96 to Conner Avenue has a curb and gutter at the outside edge of pavement, then a raised shoulder with a steep cut slope (1:3 or 1:2) up to the service drive grade.

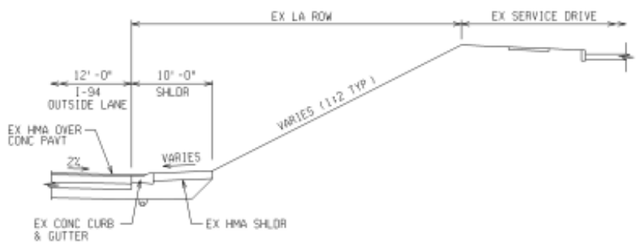



*Exhibit P7.1*

DETAIL OF EX EB & WB I-94
OUTSIDE SHOULDER

**AS DESIGNED:**

The current DEIS details a flush 12'-0" shoulder out to a single face barrier against a retaining wall up to the service drive grade.

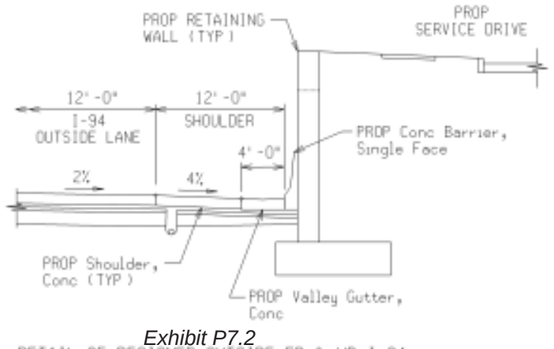



*Exhibit P7.2*

DETAIL OF DESIGNED OUTSIDE EB & WB I-94
SHOULDER W/ SINGLE FACE BARRIER

The cost of construction for the single face barrier in front of the retaining walls is:

Concrete Barrier Wall:
2 x 37,500 ft. x $90.00/ft. $ 6,750,000
Shoulder:
(2 x (37,500 ft. x 12 ft.)/9) x $90.00/syd = $ 9,000,000
$ 15,750,000

**VE PROPOSAL:**

Construct a flush 12 ft. outside shoulder with a valley gutter as part of the shoulder or use a G1 curb with gutter pan as part of the shoulder located adjacent the retaining wall.

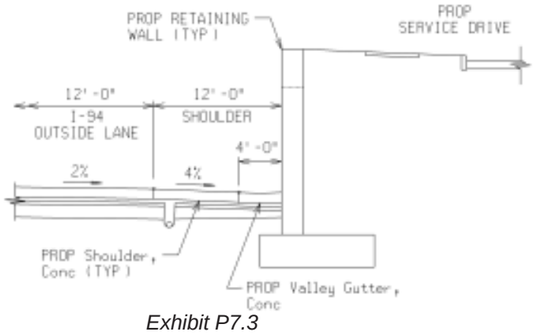



*Exhibit P7.3*

DETAIL OF PROP OUTSIDE EB & WB I-94
SHOULDER W/ VALLEY GUTTER

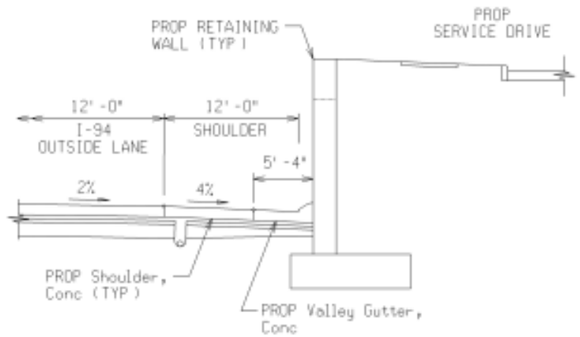



*Exhibit P7.4*

DETAIL OF PROP OUTSIDE EB & WB I-94
SHOULDER W/ G1 CURB

The valley gutter option cost is:

Shoulder:
(2 x (8 ft. x 37,500 ft.)/9) x $90.00/syd. $ 6,000,000
Valley Gutter:
2 x 37,500 ft. x $18.00/sft. = $ 1,350,000
$ 7,350,000

The G1 curb option cost is:

Shoulder:
(2 x (8 ft. x 37,500 ft.)/9) x $90.00/syd. $ 6,000,000
Curb, G1:
2 x 37,500 ft. x $19.50/ft. = $ 1,462,500
$ 7,462,500

| First Cost | | | |
|---|---|---|---|
| **Item** | **As Designed** | **VE Proposal** | **Cost Difference** |
| Valley Gutter | $15,750,000 | $7,350,000 | $8,400,000 |
| or | | | |
| G1 Curb | $15,750,000 | $7,462,000 | $8,288,000 |

## Shift Mainline I-94 Alignment Through M-10 Interchange

Proposal 8

1 of 3

**EXISTING CONDITION:**

The EB and WB I-94 alignments are split through the M-10 interchange with a variable median width. This original design accommodates the interchange configuration with left hand entrances and exits. The EB I-94 to NB M-10 and WB I-94 to SB M-10 exit ramp movements are left hand exits. The SB M-10 to EB I-94 and NB M-10 to WB I-94 entrance ramp movements are left hand entrances.

**AS DESIGNED:**

The proposed design eliminates the left hand I-94 and M-10 exits and entrances for the interchange and closes the median. The distance between the EB and WB I-94 edge of pavement is proposed to be 30 ft. (2-14 ft. shoulders and a six ft. median). The proposed centerline of I-94 is south of the existing centerline at Rosa Parks. It curves to the north at Trumbull with a 4,000 ft. radius, 1,119 ft. long curve. Through the M-10 interchange, a very large radius curves to the north (11,500 ft. radius, 818 ft. long) is also proposed. This creates a "broken back" alignment. Between 2nd and Cass, a 2 degree 45 minute curve to the right is proposed to match to the existing centerline alignment. The proposed length of this curve is 370 ft.

**VE PROPOSAL:**

Objective: Reduce the impact on Wayne State University baseball field and eliminate the "broken back" alignment.

The VE team developed U.S. Customary Units alignments from the Recommended Alternative Exhibit. The As Designed alignments are indicated in blue on Exhibit P8.1.

A local stationing was established with Station 100+00 starting at the beginning of the metric stationing. Curve data was developed in GeoPak for the I-94 horizontal geometrics through the M-10 interchange. The three curves from Trumbull to 2nd Street are shown below.

**As Designed Curve Data**

| | Curve 103 | Curve 104 | Curve 105 |
|---|---|---|---|
| Delta | 16°01'53" (LT) | 4°4'37" (LT) | 10°11'20" (RT) |
| Degree | 1°25'57" | 0°29'54" | 2°45' 00" |
| Radius | 4,000.00' | 11,500.00' | 2,083.48' |
| Length | 1,119.21' | 818.29' | 370.51' |
| PC Station | 137+49.59 | 162+34.32 | 181+01.28 |
| PT Station | 148+68.80 | 170+52.61 | 184+71.79 |

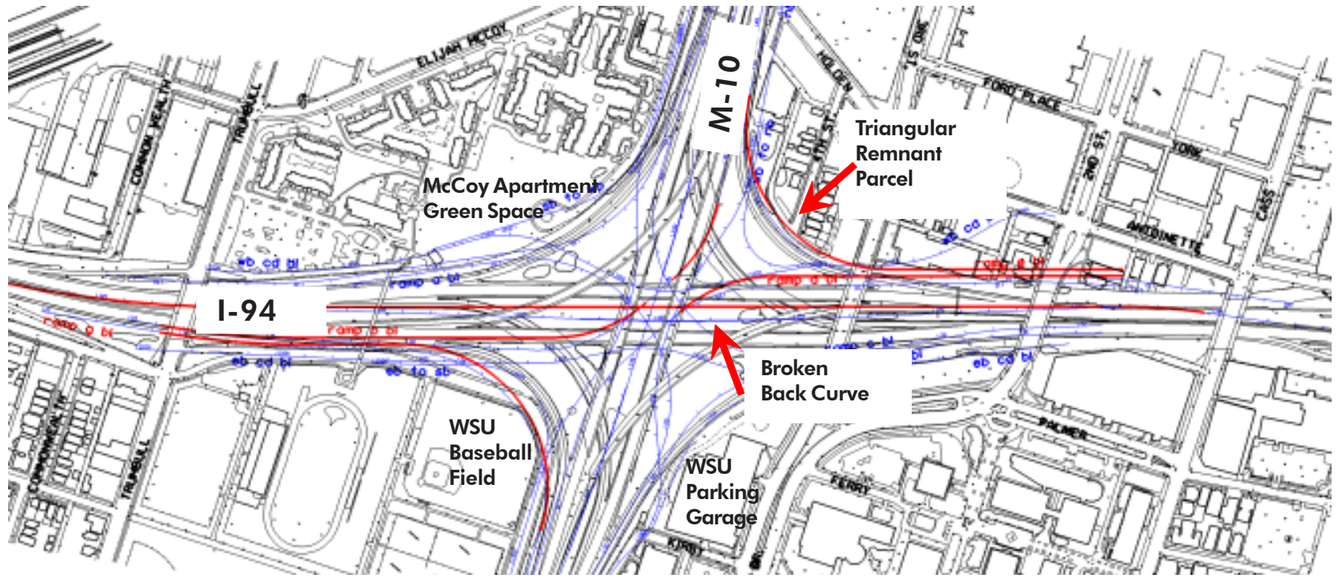



*Exhibit P8.1*

The alignment of I-94 from east of Trumbull to east of 2nd Street can be simplified by eliminating the 11,500 ft. radius horizontal curve within the interchange. The modification would begin just east of Trumbull by lengthening the proposed 4,000 ft. radius curve near Trumbull. A new "ahead" tangent would be established that is the "common" tangent to the curve at Trumbull and the 2 degree 45 minute curve at 2nd Street. The 370 ft. curve at 2nd Street would be shortened to 291 ft. by this change. The revised alignment for I-94 and several ramps is shown in red on Exhibit P8.1.

The revised curves are shown below.

**VE Proposal Curve Data**

| | Curve 103A | Curve 104 | Curve 105A |
|---|---|---|---|
| Delta | 17°56'09" (LT) | Eliminated | 8°00'59" (RT) |
| Degree | 1°25'57" | | 2°45' 00" |
| Radius | 4,000.00' | | 2,083.48' |
| Length | 1,252.16' | | 291.50' |
| PC Station | 137+49.59 | | 181+78.61 |
| PT Station | 150+01.75 | | 184+70.11 |

Highlighted items are revised from As Designed data.

The AASHTO "minimum length of curve" requirement for horizontal curves is 500 ft. for a central angle of 5 degrees or larger. For "main highways" the minimum requirement is 15 times the design speed in mph. With a mainline design speed of 60 mph the length should be 900 ft. The "as designed" length of 370 ft. violates this requirement. However, this criteria is not typically considered a "controlling" design criteria, and not typically necessary to be listed as a design exception. If the 370 ft. is acceptable, the 291 ft. may also be acceptable. Although the mainline is constrained horizontally between 2nd and Cass, a larger radius should be investigated to lengthen the curve.

The new tangent through the interchange shifts the alignment up to 50 ft. to the north. The shift adjacent to Wayne State baseball diamond is 35 ft. The EB to SB ramp moves 15-20 ft. away from the "as designed" ramp at the centerfield wall.

***Southwest Quadrant***

The shift of I-94 to the north allows the EB exit to NB and SB M-10 to also shift. The exit is currently parallel to I-94. As the I-94 bearing is rotated to the north, the exit ramp could be moved further away from the field. This will allow more room for the EB to SB ramp, which is currently proposed with a 510-foot-radius. This radius is the minimum allowed for a design speed of 40 mph with 6% superelevation. This change, in conjunction with other alignment revisions, would reduce the impact on the existing right-of-way of the baseball diamond. The shift would also provide additional clearance between the exit ramp and the EB service drive to facilitate the structure and retaining wall.

*Exhibit P8.2*
*Looking east along existing service drive next to WSU baseball field.*

***Southeast Quadrant***

The shift would allow a minor improvement to the alignment of the EB service drive between 3rd and 2nd Streets due to the SB to EB ramp also shifting to the north. This may either minimize the impact on the existing parking lot or make it more feasible to fit within the identified right-of-way acquisition. Any shift to the north of this ramp, would allow the NB to EB service drive to be shifted north also, which may increase the clearance between the service drive and the existing parking garage north of Kirby.

*Exhibit P8.3*
*Looking north along proposed NB service drive at WSU parking structure.*

## Shift Mainline I-94 Alignment Through M-10 Interchange

**Proposal 8**

**3 of 3**

***Northeast Quadrant***

The shifting of the mainline I-94 alignment to the north will also shift the WB to SB and NB ramps to the north. There appears to be room north of the existing ramp alignment to shift the WB to NB ramp north. A vacant triangular remnant parcel is identified as a possible additional taking to meet the proposed geometrics. The house in the photo is located on the lot directly north of the triangular parcel. To minimize the impact on the homes along 4th Street, the separation between the WB exit ramp and WB I-94 could be reduced. A realignment of the WB service drive appears to be possible to not conflict with the shifted WB exit ramp.

*Exhibit P8.4*
*Looking east at a home along 4th Street.*

***Northwest Quadrant***

By shifting I-94 to the north, additional right-of-way may be needed from the McCoy Apartments green space. The current proposed right-of-way shown near the cul-de-sac appears to be for the original service road alignment, and may be adequate. Even if additional right-of-way is required it should not impact the main parcel.

*Exhibit P8.5*
*Looking east at existing cul-de-sac and McCoy Apartment green space.*

**RECOMMENDATION:**

This realignment is recommended since it minimizes the impact on the Wayne State baseball field. To a lesser extent is the advantage of the additional flexibility that would be provided in the southeast quadrant. Determination of the acceptable clearance from the WB to NB ramp, which will be on structure, to the homes along 4th Street is the critical decision that will affect the feasibility of this proposal.

**COST ANALYSIS:**

This proposal does not impact the construction cost since approximately the same quantity of pavement and bridges will be required. There may be a change in the right-of-way costs based on the final takes from each parcel.

## Shorten All Pedestrian Bridges to Touch Down Between Service Drives and Mainline

Proposal 9

1 of 3

**EXISTING CONDITION:**

Existing pedestrian structures generally do not span service drives.

**AS DESIGNED:**

Pedestrian bridges over I-94 and M-10 are to span the service drives on both sides of the mainline.

It is assumed that 245 ft. pedestrian ramps are required to touch down from the structure 15'-6" above the service drives, approximately 200' of which will be built on structure for each ramp. $80/SF ft. is used for structure cost. Costs are as follows:

*Exhibit P9.1*


*Exhibit P9.2*

| | As Designed | | | | | |
|---|---|---|---|---|---|---|
| | Ped Bridge Cost (1999) | ROW description | ROW Cost | Rec. Alt Mod 1 | Rec. Alt Mod 1 | Total |
| Holden Street | $691,200 | 2,800 sq ft of Hosp parking lot | $260,000 | 11200 | $896,000 | $1,156,000 |
| Wayne State (South on M-10) | $710,400 | 4,500 sq ft of vacant lots (2) | $225,000 | 13400 | $1,072,000 | $1,297,000 |
| Helen Street | $729,600 | 14,400 sq ft of vacant lots (4) | $100,000 | 8880 | $710,400 | $810,400 |
| Townsend Street | $720,000 | 6,600 sq ft of vacant lots (2) | $100,000 | 9120 | $729,600 | $829,600 |
| Iroqouis Street | $700,000 | 3,300 sq ft of vacant lots (2) | $100,000 | 11800 | $944,000 | $1,044,000 |
| Rohns Street | $729,600 | 3,900 sq ft and one house | $300,000 | 11800 | $944,000 | $1,244,000 |
| Springfield Street | $691,200 | 6,400 sq ft of 2 Wayne St. properties | $500,000 | 9120 | $729,600 | $1,229,600 |
| | **$4,972,000** | | **$1,585,000** | **75320** | **$6,025,600** | **$7,610,600** |

## Shorten All Pedestrian Bridges to Touch Down Between Service Drives and Mainline.



**VE PROPOSAL:**

Build pedestrian structures to span mainline and touch down before service drives. The pedestrian bridge touch downs are to be located between the mainline and the service drives. Pedestrian traffic at service drives will be controlled with pedestrian actuated signal crossings.

**JUSTIFICATION:**

***Advantages:***

- Reduced height of pedestrian bridge.
- Reduced deck area.
- Less ROW take required.
- Less potential for structure hits with no structure over service drive.
- Reduced maintenance with shorter bridges.
- Less ROW/neighborhood impact.

***Disadvantages:***

- New signals may interrupt traffic flow.
- Pedestrians are not separated from service drive traffic.
- Increased signal maintenance.

***Assumptions:***

- Holden Street required 13 ft. clearance to be handled by ramps.
- Wayne State University (south of M-10) required six foot clearance to be handled by ramps.
- Helen Street shifts EB service drive to the south.
- Townsend Street required 10 ft. clearance to be handled by ramps. Shift pedestrian bridge west if possible.
- Iroqouis Street required six foot clearance to be handed by ramps.
- Rohns Street required three foot clearance to be handled by ramps.
- Springfield Street required six foot clearance to be handled by ramps.

**Proposed Pedestrian Bridge Cost Estimate:**

| | Bridge Area | Ramp Area | Ped Bridge Cost |
|---|---|---|---|
| Holden Street | 4,000 | 4,080 | $646,400 |
| Wayne State (South on M-10) | 4,200 | 1,920 | $489,600 |
| Helen Street | 2,460 | 0 | $196,800 |
| Townsend Street | 4,100 | 3,120 | $577,600 |
| Iroqouis Street | 4,400 | 1,920 | $505,600 |
| Rohns Street | 3,900 | 960 | $388,800 |
| Springfield Street | 2,520 | 1,920 | $355,200 |
| | | | |
| **Totals** | **25,580** | **13,920** | **$3,160,000** |

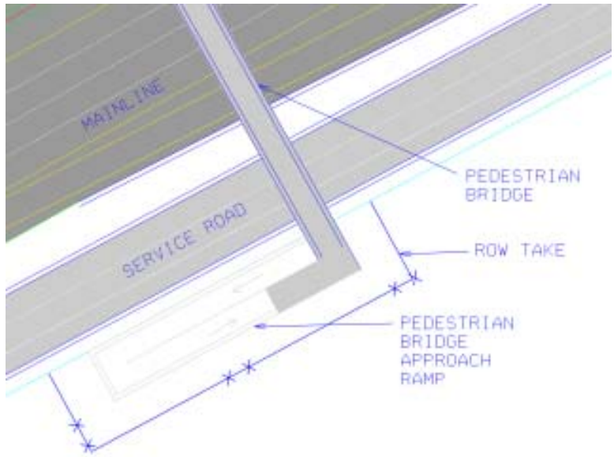
Ped bridge cost = $80/SF

| | Signals | Total |
|---|---|---|
| Holden Street | $27,800 | $674,200 |
| Wayne State (South on M-10) | $55,600 | $545,200 |
| Helen Street | $55,600 | $252,400 |
| Townsend Street | $55,600 | $633,200 |
| Iroqouis Street | $55,600 | $561,200 |
| Rohns Street | $55,600 | $444,400 |
| Springfield Street | $55,600 | $410,800 |
| | | |
| Totals | **$361,400** | **$3,521,400** |

Ped bridge cost = $80/SF

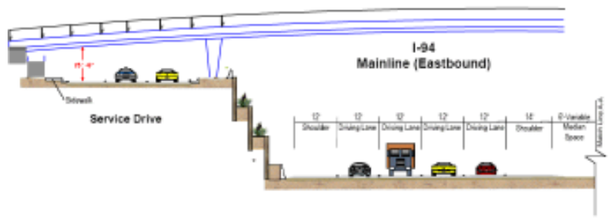
| Shorten All Pedestrian Bridges to Touch Down Between Service Drives and Mainline. | Proposal 9<br><br>3 of 3 |
|---|---|

**AS DESIGNED:**




Plan View

**AS DESIGNED:**

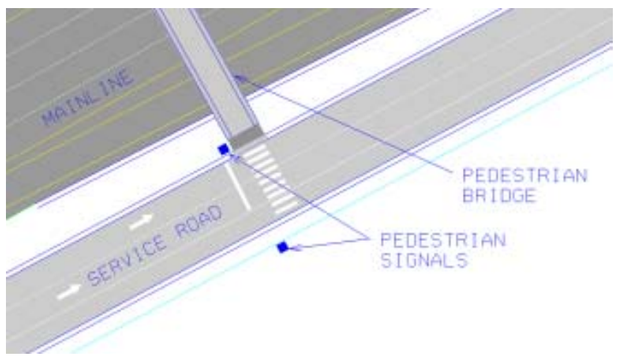



**RECOMMENDATION:**

It is recommended that the pedestrian bridge touch downs are to be located between the mainline and the service drives, with pedestrian actuated signal crossings at the service drives.

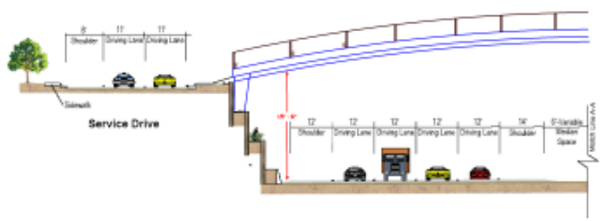
This will shorten and lower the pedestrian bridges and keep the structures in configurations similar to their current configurations in most cases.

**VE PROPOSAL:**




Plan View

**VE PROPOSAL:**




| First Cost | | | |
|---|---|---|---|
| **Item** | **As Designed** | **VE Proposal** | **Cost Difference** |
| Pedestrian Bridge in Proposal | $7,610,600 | $3,521,400 | $4,089,200 |

## Reconfigure E. Grand Blvd. with Service Drive Near GM Plant, to Reduce or Eliminate Need for ROW from GM

**Proposal 10**

**1 of 3**

**EXISTING CONDITION:**

Existing East Grand Blvd. is a divided roadway that crosses I–94 east of Chene. From the crossing of I-94, it turns west with a progressively wider median and directional median crossovers. An at-grade intersection exists at Chene, and the road turns north in line with St. Aubin at the west side of the GM plant. St. Aubin ties into East Grand Blvd. after passing under I-94. The existing WB service drive terminates at East Grand where East Grand turns west.

**AS DESIGNED:**

A continuous WB service drive is proposed for the entire length of the project, including the area between existing East Grand Blvd. and St. Aubin. In order to accommodate this WB service drive, East Grand Blvd. is pushed north with a narrow median. This requires the acquisition of approximately 190,000 sft. of ROW from General Motors (GM) (variable 10 ft. to 145 ft. width across approximately 2,450 ft.).

The design includes traffic signals at the WB service drive intersections of Chene, East Grand Blvd. and the East GM driveway. A crossover from the GM Blvd. entrance east of Chene is also provided. The designed configuration allows direct left turns from the WB service drive to SB East Grand Blvd. and from the SB GM Blvd. entrance to the WB service drive. Direct lefts are also provided from NB East Grand Blvd. to the WB service drive, and from EB East Grand Blvd. to both NB Chene and NB GM Blvd. entrance. Direct lefts from WB East Grand Blvd. to SB Chene and from NB Chene to East Grand Blvd. are not permitted. St. Aubin is extended north to tee into relocated East Grand Blvd. in approximately the same fashion as the existing condition.


*Exhibit P10.1*
*As Designed*

| Reconfigure E. Grand Blvd. with Service Drive Near GM Plant, to Reduce or Eliminate Need for ROW from GM | Proposal 10<br>2 of 3 |
|---|---|

**VE PROPOSAL:**

An opportunity to reduce or eliminate the need for ROW from GM was recognized during the VE Development Phase and gives MDOT an alternate means to provide the same functionality in this location if problems arise during ROW negotiations.

The VE proposal is to shift East Grand Blvd. south within the existing ROW, maintaining the as-designed cross section. To accommodate the new east Grand alignment, the WB service drive is shifted adjacent to I-94 between the GM Blvd. entrance and the east GM Driveway. The East Grand Blvd. structure over I-94 is extended north and the WB service drive is grade separated to pass under East Grand Blvd. Assuming a superstructure depth of 6 ft., there appears to be sufficient distance to achieve 14'-6" vertical clearance over the service drive with longitudinal service drive grades of 3% to 4%. In order to accommodate the shifted and grade separated service drive, retaining walls are required on the north side of the service drive and concrete median barrier on the south side to separate service drive traffic from WB I-94 traffic.

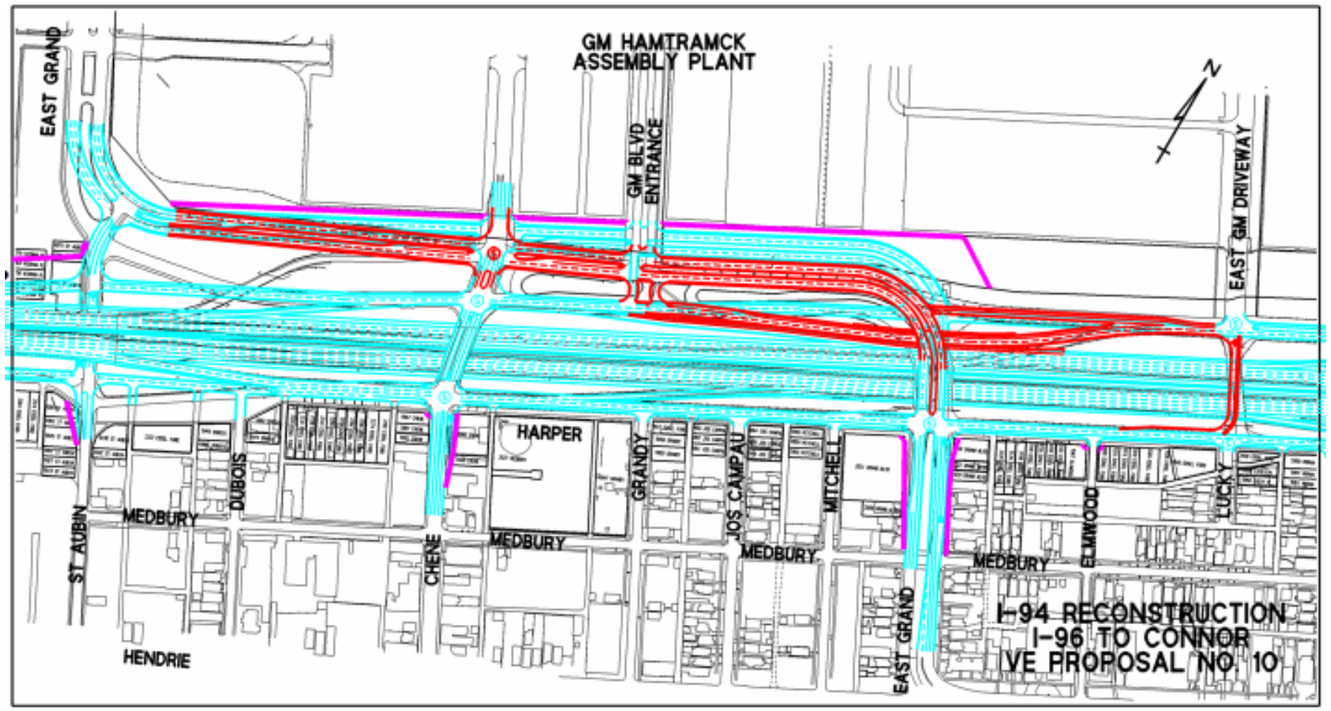



*Exhibit P10.2*
*VE Proposal*

All of the As Designed turning movements are maintained by the VE proposal, however, the following as-designed direct left turns are replaced with indirect lefts:

1. WB Service Drive to SB East Grand Blvd.
2. NB East Grand Blvd. to WB Service Drive

The NB East Grand Blvd. to WB service drive indirect left turn requires a U-turn structure over I-94, which would be located at the As Designed signalized intersection of the WB service drive and the east GM Driveway.

The advantages of this proposal are that it provides the same functionality as the As Designed alternative without the need to acquire permanent ROW from GM and provides direct access to the east GM Driveway from the EB service drive. The disadvantages are increased project cost and the replacement of two direct left turn movements with indirect movements.

**COST COMPARISON**:

This cost comparison is based on the fact that the VE Proposal will include all of the roadway costs associated with the as-designed alternative, and that the cost differential will be the difference between the additional roadway costs (lengthened East Grand bridge over I-94, U-turn structure at east GM driveway, retaining walls, concrete median barrier, additional excavation to grade separate WB service drive and East Grand Blvd., and additional one lane service drive) and the R.O.W. cost at the GM parcel.

As Designed cost (ROW savings) = $800,000

**Reconfigure E. Grand Blvd. with Service Drive Near GM Plant, to Reduce or Eliminate Need for ROW from GM** | **Proposal 10** | **3 of 3**

VE Proposal cost (additional road/bridge/wall costs):

1. Additional service drive costs (one lane);
   WB RT turn ramp to WB E. Grand Blvd.
   750 ft. x $276.39**/Lane-Ft. = $ 207,292
   EB LT turn to U-turn @ east GM Drive
   250 ft. x $276.39**/Lane-Ft. = $ 69,097
   $ 276,390

   **VE team estimated cost of single lane service drive.

2. Additional bridge costs:
   East Grand Blvd. over I-94
   50 ft. x 94 ft. x $80.00/sft. = $ 376,000
   U-turn structure @ east GM Drive
   200ft. x 40 ft. x $80.00/sft. = $ 640,000
   $1,016,000

3. Retaining wall costs (northside of WB service drive at East Grand Blvd.):

   -W. side of East Grand Blvd.: 180 ft. wall
   180 ft. x ((5 + 14.5)/2) $100 = $ 175,500
   -E. side of East Grand Blvd. = 230 ft. wall
   230 ft. x ((5 + 14.5)/2) $100 = $ 224,250
   $ 399,750

4. Additional excavation to grade separate service drive:

   -W. side of East Grand Blvd.
   650' x (1(37)+ 14.5(37))/2 = 186,387.50 cft.
   = 6,903.24 cyd. 6,903.24 CYD x $5.00 = $ 34,516

   -E. side of East Grand Blvd. =
   570' x (14.5(37)+ 1(37))/2 = 163,447.50 cft.
   = 6,053.61 cyd. 6053.61 cyd. x $5.00 /cyd.= $ 30,268
   $ 64,784

5. Additional double face concrete median barrier

   (Between service drive and I-94)
   1,230 ft. x $68.00/ft. = $83,640

6. Total VE Proposal cost

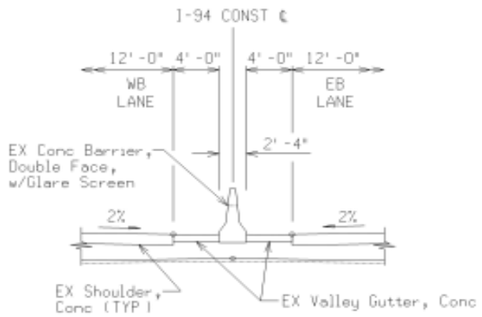
   $276,390 + $1,016,000 + $399,750 + $64,784 + $83,640 = $1,841,000

| First Cost | | | |
|---|---|---|---|
| **Item** | **As Designed** | **VE Proposal** | **Cost Difference** |
| ROW | | | $800,000 |
| Roadway/ Walls/Bridges | | | ($1,841,000) |
| | | | ($1,041,000) |

| Use 2'-4" Median Barrier for I-94 Mainline, and Widen Out Only at Structures | Proposal 11<br>1 of 1 |
|---|---|

**EXISTING CONDITION:**

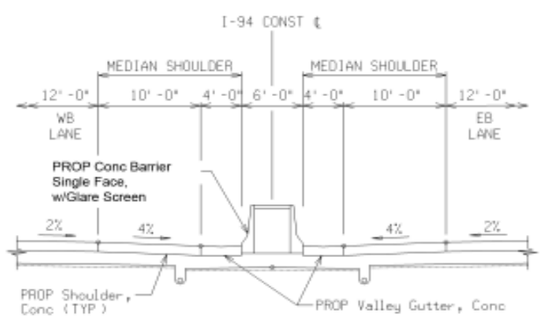
I-94 from I-96 to Conner Avenue has a standard median barrier (2'-4" wide) and tapers out as required at median bridge piers and signs.




DETAIL OF EXISTING MEDIAN EB & WB I-94

**AS DESIGNED:**

The current DEIS shows a 6'-0" (split) median barrier with 14'-0" median shoulders.



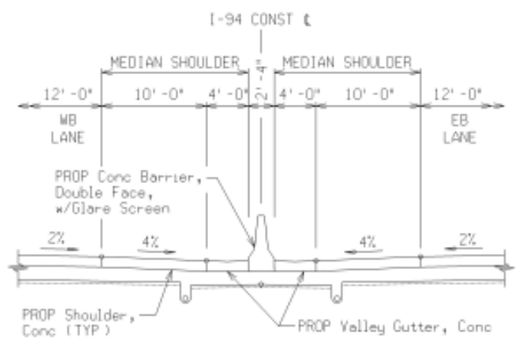

DETAIL OF AS DESIGNED MEDIAN EB & WB I-94

The total length of the project assumed for this proposal is 37,000 sf., which is based on the total concrete barrier length of 150,000 lft. in the DEIS cost estimate. This length is for four runs of barrier, two in the median and one on each outside shoulder. The cost of constructing a six-foot-wide split median barrier is:

2 x 37,500 ft. x $90.00/ft. = $ 6,750,000

**VE PROPOSAL:**

Place a standard 2'-4" wide double face median barrier with 14'-0" median shoulders the entire project length. When bridge piers or large sign foundations are located in the median the median barrier would be tapered out per standards and the 14'-0" median shoulders reduced in width by one to two feet at the pier or sign. The median barrier could be widened to 6'-4" and still maintain the minimum required 12'-0" median shoulder. This option would reduce bridge costs and provide more area along the frontage road. The disadvantage is that the barrier width would vary through the corridor. The 2'-4" width is current MDOT practice and would still provide a 12'-0" median shoulder.




DETAIL OF MEDIAN EB & WB I-94 w/ 2'-4" MEDIAN BARRIER

The cost of this VE Proposal is:

Split Barrier Length
- 33 median bridge piers for 2,220 ft.
- 15 median sign foundations for 150 ft.
- 1:24 tapers for 48 locations for 4,608 ft. for a total of 6,978 ft.

Standard 2'-4" Barrier Cost
37,500 ft. - 6,978 ft. x $50.00/ft. = $ 1,526,100

Split Barrier Cost
2 x 6,978 ft. x $80.00/ft. = $ 1,116,480

$2,642,580

Additional savings are achieved in the structures, which will have shorter spans. Those savings are $1,310,750.

| First Cost | | | |
|---|---|---|---|
| **Item** | **As Designed** | **VE Proposal** | **Cost Difference** |
| Road | $6,750,000 | $2,642,580 | $4,107,420 |
| Bridge | | | $1,310,750 |
| | | | $5,418,170 |

## Reduce Amount of Construction on M-10, South of the I-94 Interchange

**Proposal 12**

**1 of 2**

**DESCRIPTION:**

This proposal provides for the elimination of substantial reconstruction along the south leg of the I-94 / M-10 system interchange. Specifically, it is proposed to eliminate the planned reconstruction for 4,300 lineal ft. of M-10 freeway, including recommended ramp braiding, bridge removal and reconstruction, and retaining wall construction.

**EXISTING CONDITION:**

The existing M-10 freeway, south of I-94, consists of a 6-lane freeway within a depressed section. It includes turf side slopes and perimeter service drives along the SB and NB right-of-way. The ramp terminals with I-94 are single lane ramps, with the WB to SB ramp joining SB M-10 on the median side, and with the NB to WB ramp leaving NB M-10 from the median side. Proceeding south, there is a pedestrian bridge over M-10, joining the Wayne State University (WSU) campus and athletic fields. There is a significant traffic bridge for Warren Avenue. There is a traffic bridge for Forest Avenue, including U-turn roadways on the north and south sides. There is a pedestrian bridge near Canfield. The freeway includes four slip ramps to and from the SB and NB service drives, with entrances and exits located south and north of Forest Avenue. Auxiliary lanes are found between the Forest Avenue ramps and the right side ramps to and from I-94.

**AS DESIGNED:**

The original design found in the Draft Environmental Impact Statement, January 2001, and the Recommended Alternatives Analysis Final Report, August 2002, did not include any reconstruction south of Warren Avenue, except for approximately 300 lf. of SB roadway reconstruction to accommodate a ramp taper. The cost of this 4,300 lf. reconstruction is estimated to be $31.1 million and is not included in the DEIS cost estimate for the M-10 reconstruction. It included substantial modifications to the system ramps to and from I-94. Specifically, the system ramps are to be reconstructed to include right-side exit and entrances. The exits and entrances to and from I-94 are two lanes, with attendant auxiliary lanes between the NB entrance ramp (from Forest) and the NB system ramps and between the SB system ramps and the SB exit ramp (to Forest). Due to interference with the new system ramps, the pedestrian bridge at WSU will be removed and fully replaced. The original design matches into the existing M-10 freeway at approximately Forest Avenue, keeping all four existing slip ramps at Forest intact. The remaining ramp spacing between the NB service ramp, from Forest, and the system ramps to I-94 is approximately 750 ft. This is substantially substandard to the 2000 ft. recommended by AASHTO 's "Policy on Geometric Design of Highways and Streets." GDHS (2001). Nonetheless, year 2025 peak hour operations for the NB roadway were expected to operate at Level of Service B through D, based on HCM analyses.

During 2003, there was concern for the substandard ramp spacing along the M-10 NB and SB roadways. Through a series of meetings with MDOT and FHWA it was determined that an alternative design be analyzed. *[**Note:** This design modification will be suggested in the forthcoming Interchange Access Justification Report (IAJR); however, the following design modifications are not in the current cost model, as provided to the VE team.]* The design modification extends the south project limits another 4,300 lineal feet. It includes the relocation of the NB entrance ramp from Forrest to a location approximately 900 feet further south, putting the NB entrance ramp on a tight braid over the NB exit ramp. This design includes a new ramp structure and substantial retaining walls. However, it revises the ramp spacing from 750 feet to 1750 feet, providing LOS B through C operations (from LOS D, which is “acceptable”). The existing SB exit ramp to Forest is removed and is replaced with a new SB slip ramp that exits in the vicinity of the EB roadway for I-94, then proceeds southerly as a braid under the SB system ramps, and then joining with the SB service drive in the vicinity of the WSU athletic fields, north of the pedestrian bridge at WSU. As required in the original proposal, the Warren Avenue bridge will be replaced with a longer bridge. The revised design includes the additional removal and replacement of the Forest Avenue bridge and the additional


*Exhibit P12.1*

removal and replacement of the Canfield pedestrian bridge. The Canfield pedestrian bridge is relocated another 900 feet further south of the existing location to accommodate the NB ramp braiding. [This bridge appears as U-turn structure on the large exhibits and is assumed to be a graphical error.] Since new bridges are required, it was determined to extend the SB auxiliary lanes further south, all the way to the exit ramp to Grand River. This, in turn, requires substantial retaining wall construction between the SB service drive and freeway.

**VE PROPOSAL:**

Idea #60, which became Proposal 12, suggests that the design team revert to the original design, as described in the DEIS and Recommended Alternative Report. In addition, to fully mitigate the substandard ramp spacing along the NB roadway in the vicinity south of the I-94 system ramp terminal, additional modifications are required:

- It is proposed to relocate the NB entrance ramp from a location near Forest Avenue to a location off of the NB service drive near the Kirby Street intersection. This will require a short weave/auxiliary lane south of the proposed NB exit ramp to the NB service drive/ Milwaukee within the I-94 interchange. This design will be a mirror image of the proposed service ramp design found along the SB roadway. The highest Year 2025 weave volumes are expected to occur during the PM peak hour when 1020 vehicles enter NB M-10 and 420 vehicles exit toward Milwaukee. This weave volume is similar to the weave volume on the SB side (380 entering and 1135 leaving SB M-10) where LOS D operations were calculated. Actual LOS is likely to be better on the NB side since the entering vehicles will include a traffic demand less than that noted above. This demand volume is less with the lack of access to EB or WB I-94.

These trips will need to find alternate routes to access I-94. Local access to WB I-94 will be via the WB service drive, with entry to I-94 near Trumbull. Local access to EB I-94 will be via the EB service drive, with entry to I-94 near Linwood and Kirby.

- As revised during the past seven months, it is proposed to fully remove the existing SB exit ramp to Forest since a SB exit ramp is already proposed at location only 1800 feet to the north. However, traffic along EB and WB I-94 that desires to exit in the vicinity of Forest will now need to exit at other ramps. EB and WB traffic destined for the WSU campus area will need to exit at the ramps prior to Trumbull and then use the EB service drive.

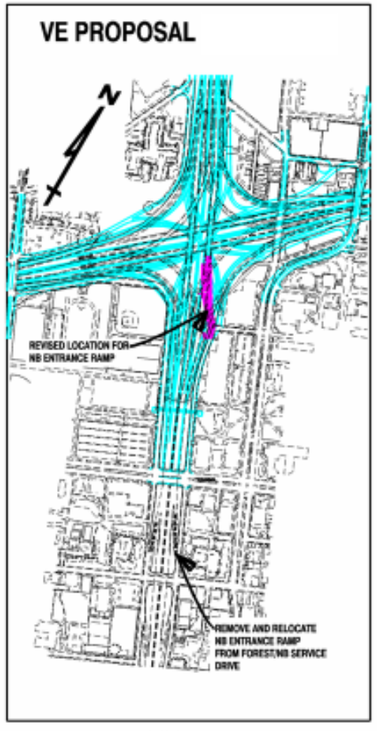



*Exhibit P12.2*

- The extension of the SB auxiliary lanes to Grand River, and the attendant retaining wall construction, can be deferred until future reconstruction of M-10.

**OBJECTIVE AND RECOMMENDATION:**

The objective of this idea is to significantly reduce project costs, without any degradation of future traffic operations. It is recommended to construct the VE Proposal.

**COST IMPACT:**

The elimination of construction work south of Forest will save approximately $31.7 million. This will be partially offset by the costs associated with the relocation of the NB entrance ramp and attendant bridge widening costs over I-94. These costs are estimated at $0.7 million dollars. If Proposal 12 is not adopted, the DEIS construction cost estimate will be increased by $31.7 million.

## 8.3 Cost Model

### Introduction

The cost estimate for the proposed I-94 reconstruction and widening is shown below. The cost estimate is presented in conformance with ASTM Standard Classification for Allocated Sums in Construction. In conventional estimating, a percentage of the estimated construction cost will be added as a contingency to compensate for design and construction unknowns (changes and risks) at the concept phase, such as utilities and right-of-way. ASTM has developed a process in which these contingencies are divided into three parts; allowance, contingency and reserve. In this way, the intent of each are explained and the purpose of cost allocation will be well defined.

The costs corresponding to the four cost categories described below are combined to form three successive levels of cost totals: minimum, expected and maximum cost estimates.

**VE Cost Summary**

| | | |
|---|---|---|
| Base Cost | $334,934,000 | |
| Allowance | $308,344,000 | |
| **Total Minimum Construction Cost (2001)** | | **$643,278,000** |
| **Total Minimum Construction Cost (2002)** | | **$675,442,000** |
| **Total Minimum Construction Cost (2004)** | | **$744,675,000** |
| Contingency | $132,219,000 | |
| **Total Expected Construction Cost (2001)** | | **$775,497,000** |
| **Total Expected Construction Cost (2002)** | | **$814,272,000** |
| **Total Expected Construction Cost (2004)** | | **$897,735,000** |
| Reserve | $203,593,000 | |
| **Total Max. Construction Cost (2001)** | | **$979,090,000** |
| **Total Max. Construction Cost (2002)** | | **$1,028,045,000** |
| **Total Max. Construction Cost (2004)** | | **$1,133,420,000** |

### Minimum Construction Cost

The minimum construction cost is an estimate of all construction work that will be the basis to forecast a reasonable construction cost. It includes base costs and certain allowance costs.

*Base Cost*

Base costs are developed from easily quantifiable, well-known, and reliable quantities and unit costs. The base costs are the known costs of the project. It is a sum of money intended to be spent. For example, the $14.2 million cost to retrofit the Dequindre Bridge to accommodate the proposed mainline cross section is a base cost. The base cost for the cost model is the DEIS estimate from Exhibit 4.1 with two revisions; reduced costs for "Drainage" and "Pump Stations" as defined in the drainage section.

*Allowance*

The allowance ensures a full and complete estimate.

The allowance is a sum of money intended to be spent. However, unlike base costs, allowances are used in the absence of precise knowledge, and estimated to ensure a full and complete estimate. Allowances cover events and activities that are normally internal and so are directly controllable within the project plan. There are two types of allowance costs, specific and nonspecific. Where the content of the sum is uniquely identified and the sum is calculated solely for that purpose, it is specific. When the content of the sum is broadly identified and the sum is calculated for general purpose, it is nonspecific. For example, $35.6 million has been included in the allowance to account for the difference in the DEIS total bridge cost and VE estimate for bridges.

### Base Cost

| Item | Unit | Unit Cost | Quantity | Total |
|---|---|---|---|---|
| Asphalt Pavement (6/12 Section) | sq yd | $11.70 | 333,170 | $3,898,000 |
| Concrete Pavement (12/12 Section) | sq yd | $90.00 | 770,093 | $69,308,000 |
| 3" Mill and Overlay | sq yd | $9.00 | 68,442 | $616,000 |
| Removal of Surfacing | sq yd | $1.70 | 1,247,543 | $2,121,000 |
| Curb and Gutter | ft | $7.65 | 206,080 | $1,577,000 |
| Sidewalk | sq ft | $2.50 | 530,714 | $1,327,000 |
| Concrete Median Pavement | sq ft | $3.40 | 129,700 | $441,000 |
| Bridges | sq ft | N/A | N/A | $141,023,000 |
| Retaining Walls | sq ft | $60.00 | 343,114 | $20,587,000 |
| Removal of Structures | lsum | $19,876,000.00 | 1 | $19,876,000 |
| Signals | per inters. | $100,000.00 | 52 | $5,200,000 |
| Lighting | lsum | $10,000,000.00 | 1 | $10,000,000 |
| Signing | lsum | $13,000,000.00 | 1 | $13,000,000 |
| Striping | lsum | $241,000.00 | 1 | $241,000 |
| RR Crossing | per xing | $100,000.00 | 4 | $400,000 |
| Drainage | lsum | $15,819,000.00 | 1 | $15,819,000 |
| Pump Stations | ea | $2,000,000.00 | 4 | $8,000,000 |
| Concrete Wall Barrier | ft | $90.00 | 150,000 | $13,500,000 |
| Landscaping | lsum | $8,000,000.00 | 1 | $8,000,000 |
| | | | | |
| **Total Base Cost** | | | | **$334,934,000** |

### Allowance

| | |
|---|---|
| ***Specific Allowances*** | |
| Utility Relocation | $10,690,000 |
| Traffic Control | $19,170,000 |
| Drainage | $3,000,000 |
| Bridges | $35,561,000 |
| Removal of Structures | $3,908,000 |
| Retaining Walls | $21,038,000 |
| Pavement | $26,208,000 |
| Enhancement | $13,397,000 |
| ROW | $35,000,000 |
| Mobilization | $23,395,000 |
| Engineering Fee | $116,977,000 |
| ***Non-Specific Allowances*** | |
| | |
| **Total Allowance** | **$308,344,000** |

| | | |
|---|---|---|
| **Base Cost** | | **$334,934,000** |
| **Allowance** | **+** | **$308,344,000** |
| **Total Minimum Construction Cost (2001)** | **=** | **$643,278,000** |
| **Total Minimum Construction Cost (2002)** | **=** | **$675,442,000** |
| **Total Minimum Construction Cost (2004)** | **=** | **$744,675,000** |

### Expected Construction Cost

The expected construction estimate includes the total minimum construction estimate plus both specific and nonspecific contingency costs.

*Contingency*

The contingency is a sum of money not intended to be spent. It is used in the absence of precise knowledge, and estimated to ensure that a financial buffer is available within a budget. This buffer is intended to assist in mitigating the effects of unplanned events and other risks that are normally external to the project plan and so are not directly controllable. For example, the $16.5 million additional cost to widen the Dequindre Bridge shoulder from the proposed four feet to the recommended 14 ft. is included in the contingency.

### Maximum Construction Cost

The maximum construction estimate includes the expected construction estimate plus both specific and nonspecific reserve costs.

*Reserve*

The reserve is a sum of money usually held by the management (client) and not normally intended to be spent. It is used to provide insurance against a project or program failing to complete on budget or for the revision of a budget in the case of changed management or program direction and requirement. For example, the $11.2 million additional cost to replace the Dequindre Bridge superstructure in order to eliminate constraints imposed by the existing bridge alignment, profile, and superelevation is included as a reserve cost.

The following provides detail for costs associated with each element under Allowance, Contingency and Reserve. The base cost for each element is taken from the DEIS estimate except as noted under drainage.

***Utility Relocation***

*Allowance:*
- Allowance for utility relocation for mainline roadway is assumed to be 4% of base costs attributable to mainline roadway.
- Allowance for utility relocation for service drives is assumed to be 5% of base costs attributable to service drives.
- Allowance for utility relocation for bridges is estimated to be 2% of base costs attributable to bridges.

*Contingency:*
- Contingency is 100% of the total utility allowance.

*Reserve:*
- Reserve is 0% of the total utility allowance.

## Contingency

| ***Specific Contingencies*** | |
|---|---|
| Utility Relocation | $10,690,000 |
| Traffic Control | $10,790,000 |
| Drainage | $7,400,000 |
| Bridges | $16,500,000 |
| Removal of Structures | $0 |
| Retaining Walls | $27,750,000 |
| Pavement | $11,072,000 |
| Enhancement | $0 |
| ROW | $15,000,000 |
| Mobilization | $930,000 |
| Engineering Fee | $23,258,000 |
| ***Non-Specific Contingencies*** | |
| Bridges | $8,829,000 |
| **Total Contingency** | **$132,219,000** |

## Reserve

| ***Specific Reserve*** | |
|---|---|
| Utility Relocation | $0 |
| Traffic Control | $50,000,000 |
| Drainage | $40,600,000 |
| Bridges | $28,893,000 |
| Removal of Structures | $1,037,000 |
| Retaining Walls | $23,125,000 |
| Pavement | $3,691,000 |
| Enhancement | $6,699,000 |
| ROW | $0 |
| Mobilization | $0 |
| Engineering Fee | $40,719,000 |
| ***Non-Specific Reserve*** | |
| Bridges | $8,829,000 |
| **Total Reserve** | **$203,593,000** |

| | | |
|---|---|---|
| **Total Minimum Construction Cost** | | **$643,278,000** |
| **Contingency** | + | **$132,219,000** |
| **Total Expected Construction Cost (2001)** | = | **$775,497,000** |
| **Total Expected Construction Cost (2002)** | = | **$814,272,000** |
| **Total Expected Construction Cost (2004)** | = | **$897,735,000** |

| | | |
|---|---|---|
| **Expected Cosnstruction Cost** | | **$775,497,000** |
| **Reserves** | + | **$203,593,000** |
| **Total Maximum Construction Cost (2001)** | = | **$979,090,000** |
| **Total Maximum Construction Cost (2002)** | = | **$1,028,045,000** |
| **Total Maximum Construction Cost (2004)** | = | **$1,133,420,000** |

**Allowance**

| | Base Cost 2001 | | Utilities Relocation | | Element | Percentage |
|---|---|---|---|---|---|---|
| **Interchange M-10** | | $75.73 | | $2.15 | Mainline Roadway | 4% |
| Bridges | $44.04 | | $0.88 | | Service Roads | 5% |
| Roadway | $31.70 | | $1.27 | | Bridges | 2% |
| **Interchange I-75** | | $72.80 | | $1.73 | | |
| Bridges | $58.97 | | $1.18 | | | |
| Roadway | $13.83 | | $0.55 | | | |
| **Interchange Gratiot** | | $3.45 | | $0.14 | | |
| **Interchange Conner** | | $3.39 | | $0.14 | | |
| **Mainline** | | $96.09 | | $3.84 | | |
| I-96 to M-10 | $17.89 | | $0.72 | | | |
| M-10 to I-75 | $19.98 | | $0.80 | | | |
| I-75 to Conner | $58.22 | | $2.33 | | | |
| **Service Roads** | | $33.98 | | $1.70 | | |
| I-96 to M-10 | $8.15 | | $0.41 | | | |
| M-10 to I-75 | $6.93 | | $0.35 | | | |
| I-75 to Gratiot | $1.26 | | $0.06 | | | |
| Gratiot to Conner | $17.64 | | $0.88 | | | |
| **Bridges** | | $49.46 | | $0.99 | | |
| I-96 to M-10 | $6.63 | | $0.13 | | | |
| M-10 to I-75 | $12.36 | | $0.25 | | | |
| I-75 to Conner | $30.47 | | $0.61 | | | |
| | | | | | | |
| | **2001 Total** | **$334.90** | **Allowance** | **$10.69** | | |
| | | | | | | |
| **Contingency** | | | | | | |
| | | | | | **Element** | **Allowance** |
| **Contingency Total** | | | | **$10.69** | Utilities | 100% |
| | | | | | | |
| **Reserve** | | | | | | |
| | | | | | **Element** | **Allowance** |
| **Reserve Total** | | | | **$0.00** | Utilities | 0% |
| | | | | | | |
| **Utilities Total** | | | | **$21.37** | | |

*Utility Relocation*

### *Traffic Control*

This DEIS cost estimate is based on unknown MOT, construction staging and scheduling schemes. Various options are discussed in "Validation #5 - Construction Staging and Scheduling." The allowance is based on a seven-year construction duration and full closure by segment and includes staging and other construction activities. A higher percentage is used for the mainline construction and a lesser percentage is used for service drive construction.

*Allowance:*

- Allowance for traffic control for mainline roadway is assumed to be 5% of base costs attributable to mainline roadway.
- Allowance for traffic control for service drives is assumed to be 3% of base costs attributable to service drives.
- Allowance for traffic control for bridges (non-interchange) is assumed to be 5% of base costs attributable to bridges (non-interchange). The bridge percentage is calculated as follows: {$25,000/[(60 ft. x 200 ft.) x $75/sq ft.]} x 100% = 3%, say 5%. [See MDOT Design Manual 3.01.02 maintaining traffic and bridge cost.]
- Allowance for traffic control for interchanges, which includes interchange roadways and bridges, is assumed to be 7% of base costs attributable to interchange bridges and roadway.

*Contingency:*

- Contingency for traffic control for mainline roadway is assumed to be 2% of base costs attributable to mainline roadway.
- Contingency for traffic control for service drives is assumed to be 1% of base costs attributable to service drives.
- Contingency for traffic control for bridges (non-interchange) is assumed to be 2% of base costs attributable to bridges (non-interchange).
- Contingency for traffic control for interchanges, which includes interchange roadways and bridges, is assumed to be 3% of base costs attributable to interchange bridges and roadway.

*Reserve:*

- If full closure west of I-75 is desired, construction time will increase from seven to nine years. Thirty percent of allowances for traffic control are reserved for this program change {(.30 x $19,170,000) $5,751,000}. If I-94 traffic is to be maintained, a $50 million reserve should be allocated to cover the cost of the larger of the two ($50 million) is added to the reserve.

Traffic Control

**Allowance**

| | Base Cost 2001 | | Traffic Control | |
|---|---|---|---|---|
| **Interchange M-10** | | **$75.73** | | **$5.30** |
| Bridges | $44.04 | | $3.08 | |
| Roadway | $31.70 | | $2.22 | |
| **Interchange I-75** | | **$72.80** | | **$5.10** |
| Bridges | $58.97 | | $4.13 | |
| Roadway | $13.83 | | $0.97 | |
| **Interchange Gratiot** | | **$3.45** | | **$0.24** |
| **Interchange Conner** | | **$3.39** | | **$0.24** |
| **Mainline** | | **$96.09** | | **$4.80** |
| I-96 to M-10 | $17.89 | | $0.89 | |
| M-10 to I-75 | $19.98 | | $1.00 | |
| I-75 to Conner | $58.22 | | $2.91 | |
| **Service Roads** | | **$33.98** | | **$1.02** |
| I-96 to M-10 | $8.15 | | $0.24 | |
| M-10 to I-75 | $6.93 | | $0.21 | |
| I-75 to Gratiot | $1.26 | | $0.04 | |
| Gratiot to Conner | $17.64 | | $0.53 | |
| **Bridges** | | **$49.46** | | **$2.47** |
| I-96 to M-10 | $6.63 | | $0.33 | |
| M-10 to I-75 | $12.36 | | $0.62 | |
| I-75 to Conner | $30.47 | | $1.52 | |
| | | | | |

| Element | Percentage |
|---|---|
| Mainline Roadway | 5% |
| Service Roads | 3% |
| Bridges* | 5% |
| Interchanges (Bridges and Roadway) | 7% |

| | |
|---|---|
| **Base Costs 2001 Total** | **$334.90** |
| **Traffic Control Allowance Total** | **$19.17** |

**Contingency**

| | Base Cost 2001 | | Traffic Control | |
|---|---|---|---|---|
| **Interchange M-10** | | **$75.73** | | **$2.27** |
| Bridges | $44.04 | | $1.32 | |
| Roadway | $31.70 | | $0.95 | |
| **Interchange I-75** | | **$72.80** | | **$2.18** |
| Bridges | $58.97 | | $1.77 | |
| Roadway | $13.83 | | $0.41 | |
| **Interchange Gratiot** | | **$3.45** | | **$0.10** |
| **Interchange Conner** | | **$3.39** | | **$0.10** |
| **Mainline** | | **$96.09** | | **$4.80** |
| I-96 to M-10 | $17.89 | | $0.36 | |
| M-10 to I-75 | $19.98 | | $0.40 | |
| I-75 to Conner | $58.22 | | $1.16 | |
| **Service Roads** | | **$33.98** | | **$0.34** |
| I-96 to M-10 | $8.15 | | $0.08 | |
| M-10 to I-75 | $6.93 | | $0.07 | |
| I-75 to Gratiot | $1.26 | | $0.01 | |
| Gratiot to Conner | $17.64 | | $0.18 | |
| **Bridges** | | **$49.46** | | **$0.99** |
| I-96 to M-10 | $6.63 | | $0.13 | |
| M-10 to I-75 | $12.36 | | $0.25 | |
| I-75 to Conner | $30.47 | | $0.61 | |
| | | | | |

| Element | Percentage |
|---|---|
| Mainline Roadway | 2% |
| Service Roads | 1% |
| Bridges* | 2% |
| Interchanges (Bridges and Roadway) | 3% |

| | |
|---|---|
| **Contingency Total** | **$10.79** |

**Reserve**

| | |
|---|---|
| **Reserve Total** | **$50.00** |

| | |
|---|---|
| **Traffic Control Total** | **$79.97** |

### *Drainage*

DEIS cost estimate included $22.2 million for drainage and $12 million for pump stations for a total of $34.2 million as shown below.

| DRAINAGE QUANTITIES | | | |
|---|---|---|---|
| **36" RCP** | | | |
| | **Length** | **Unit Cost** | **Cost** |
| WB Frontage | 34,730 | $75.00 | $2,604,750.00 |
| EB Frontage | 33,645 | $75.00 | $2,523,375.00 |
| M-10 SB Frontage | 7,600 | $75.00 | $570,000.00 |
| M-10 NB Frontage | 7,600 | $75.00 | $570,000.00 |
| **Subtotal** | | | **$6,268,125.00** |
| | | | |
| **60" RCP** | | | |
| | **Length** | **Unit Cost** | **Cost** |
| WB Mainline | 36,170 | $145.00 | $5,244,650.00 |
| EB Mainline | 35,640 | $145.00 | $5,167,800.00 |
| M-10 SB | 7,600 | $145.00 | $1,102,000.00 |
| M-10 NB | 7,600 | $145.00 | $1,102,000.00 |
| **Subtotal** | | | **$12,616,450.00** |
| | | | |
| **Drop Inlets (every 300' on ML & M-10; every 400' on service roads)** | | | |
| | **Quantity** | **Unit Cost** | **Cost** |
| WB Frontage | 88 | $4,200.00 | $369,600.00 |
| EB Frontage | 84 | $4,200.00 | $352,800.00 |
| WB Mainline | 242 | $4,200.00 | $1,016,400.00 |
| EB Mainline | 238 | $4,200.00 | $999,600.00 |
| M-10 SB | 52 | $4,200.00 | $218,400.00 |
| M-10 NB | 52 | $4,200.00 | $218,400.00 |
| M-10 SB Frontage | 19 | $4,200.00 | $79,800.00 |
| M-10 NB Frontage | 19 | $4,200.00 | $79,800.00 |
| **Subtotal** | | | **$3,334,800.00** |
| | | | |
| Pump Stations | 6 | $200,000.00 | **$12,000,000.00** |
| | | | |
| **Total** | | | **$34,219,375.00** |

*Drainage Cost (DEIS)*

The base cost for drainage and pump stations reflects the combination of VE options 1 and 2 as described in Validation 4.

The base cost reflects the estimated savings of $10.4 million (drainage - $6.2 million and pump station - $4.2 million); therefore the base cost has been reduced to $23.8 million.

*Allowance:*
The base cost does not include a pump station at the I-94/I-96 interchange. Three million dollars has been included in the allowance to cover the cost if further detailed design requires the pump station.

- Allowance is $3,000,000

*Contingency:*
The contingency provide for construction of the drainage system provided in the DEIS in the event this is required for phased construction.

- Contingency is $7,400,000

Reserve:
VE Option 3 provided for the construction of a separate storm water system independent of the combined city system.

- Reserve is $40,600,000

### *Bridges*

Prior to the cost model analysis, the VE team reviewed the DEIS cost estimate for bridges and removal of structures. It did not correlate with the Recommended Alternative exhibits. The VE team developed the tables 8.1 and 8.2 based on the Recommended Alternative exhibits. Structure numbers, where applicable, were provided by MDOT and have been added to the table.

*Allowance:*
- The allowance accounts for the difference between the DEIS cost estimate and the validated study cost estimate, except for the two GTW/Conrail bridges that are included in the reserve. This validation detail is shown Table 8.1. The difference in cost between DEIS and VE estimate is $35,561,000, which includes $4 million for the bridges required for the work on M-10 not included in the DEIS estimate.

*Contingency:*
- Nonspecific contingency is assumed to be 5% of the sum of the bridge base cost plus bridge allowance. This will cover the walled-in area of bridges due to potential changes in profile, geometry, and construction staging of bridges.

- DEIS cost estimate for Dequindre bridge widening is $14.2 million. If the widening is not feasible and 14 ft. median is desired, cost of this improvement should be added to the contingency ($30,700,000 - $14,200,000) $16,500,000.

Nonspecific Contingency
.05($141,023,000 + $35,561,000) = $8,829,000
Specific Contingency
Dequindre Widening $16,500,000
$25,329,000

*Reserve:*
- Nonspecific reserve is assumed to be 5% of the sum of the bridge base cost plus bridge allowance.
- The first specific reserve is $17,693,000 for the two GTW/Conrail bridges not included in the DEIS cost estimate.
- The second specific reserve is for the additional cost if the Dequindre bridge, Option 6 as outlined in Validation 3a, is adopted ($41,900,000 - $30,700,000) $11,200,000.

Nonspecific Reserve
.05($141,023,000 + $35,561,000) = $8,829,000
Specific Reserve
GTW/Conrail bridges $17,693,000
Dequindre Widening $11,200,000
$37,722,000

### *Removal of Structures*

*Allowance:*
- Accounts for the difference between the DEIS quantity estimate and the VE Study cost estimate, except for the two GTW/Conrail bridges included in the reserve. The increase does account for $0.5 million for work on M-10 not included in the DEIS estimate. The validation detail is shown in Table 8.2.
- Allowance is calculated as $3,908,000.

*Contingency:*
- Contingency is assumed to be $0.

*Reserve:*
- Reserve is calculated as $1,037,000 to account for the two GTW/Conrail bridges not accounted for in the draft EIS cost estimate.

# 8.0 Development Phase

| | Bridge Cost Validation | | Construction Length | Width | Area | Unit Cost | Total |
|---|---|---|---|---|---|---|---|
| M-10 Interchange | Grand River | S17 of 82023 | 240 | 119 | 28560 | $ 80.00 | $ 2,284,800.00 |
| | Linwood | S18 of 82023 | 190 | 68 | 12920 | $ 80.00 | $ 1,033,600.00 |
| | 14th Street | S19 of 82023 | 215 | 64 | 13760 | $ 80.00 | $ 1,100,800.00 |
| | GT Western Conrail (E) over Wabash* | NOT NUMBERED | 80 | 40 | 5600 | $ 465.00 | $ 2,604,000.00 |
| | Rosa Parks | S20 of 82023 | 235 | 56 | 13160 | $ 80.00 | $ 1,052,800.00 |
| | Trumbull | S21 of 82023 | 270 | 94 | 25380 | $ 80.00 | $ 2,030,400.00 |
| | GTW/Conrail Bridge (N) over M-10 | X01 of 82112 | 350 | 24 | 8400 | $ 465.00 | $ 3,906,000.00 |
| | GTW/Conrail Bridge (S) over M-10 | X01 of 82112 | 360 | 40 | 14400 | $ 465.00 | $ 6,696,000.00 |
| | Holden Ped Bridge | P01 of 82112 | | | 11200 | $ 80.00 | $ 896,000.00 |
| | Brooklyn St. Ped Bridge | P05 of 82023 | | | 0 | - | - |
| | I-94 WB to M-10 SB (West to South) | S26 of 82023 | | | 0 | - | - |
| | M-10 SB over M-10 NB to I-94 WB | S22 of 82023 | | | 0 | - | - |
| | M-10 NB (Mainline) | S27 of 82023 | | | 0 | - | - |
| | M-10 SB (Mainline) | S24 of 82023 | | | 0 | - | - |
| | M-10 NB over I-94 WB to M-10 SB | S29 of 82023 | | | 0 | - | - |
| | I-94 EB to M-10 NB (East to North) | S25 of 82023 | | | 0 | - | - |
| | I-94 EB over I-94 EB to M-10 SB (East) | S23 of 82023 | | | 0 | - | - |
| | I-94 WB over M-10 SB to I-94 EB | S28 of 82023 | | | 0 | - | - |
| | I-94 EB SD to M-10 SB SD (East to South) | | | | 28500 | $ 120.00 | $ 3,420,000.00 |
| | I-94 EB SD to M-10 NB SD (East to North) | | | | 51000 | $ 120.00 | $ 6,120,000.00 |
| | I-94 WB SD to M-10 SB SD (West to South) | | | | 53700 | $ 120.00 | $ 6,444,000.00 |
| | I-94 WB SD to M-10 NB SD (West to North) | | | | 30900 | $ 120.00 | $ 3,708,000.00 |
| | M-10 NB to I-94 WB (North to West) | | | | 34500 | $ 120.00 | $ 4,140,000.00 |
| | M-10 NB to I-94 EB (North to East) | | | | 24000 | $ 120.00 | $ 2,880,000.00 |
| | M-10 SB to I-94 EB (South to East) | | | | 31500 | $ 120.00 | $ 3,780,000.00 |
| | M-10 SB to I-94 WB (South to West) | | | | 19500 | $ 120.00 | $ 2,340,000.00 |
| | M-10 NB (Mainline) | | | | 20400 | $ 100.00 | $ 2,040,000.00 |
| | M-10 SB (Mainline) | | | | 23800 | $ 100.00 | $ 2,380,000.00 |
| | M-10 NB SD (North Service) | | | | 10105 | $ 180.00 | $ 1,818,900.00 |
| | M-10 SB SD (South Service) | | | | 10200 | $ 180.00 | $ 1,836,000.00 |
| | Merrick Ave Ped Brridge | P07 of 82111 | | | 13400 | $ 80.00 | $ 1,072,000.00 |
| | Warren Ave Bridge | S19 of 82111 | 160 | 124 | 19840 | $ 80.00 | $ 1,587,200.00 |
| | Forest Ave Bridge | S18 of 82111 | 150 | 114 | 17100 | $ 80.00 | $ 1,368,000.00 |
| | Canfield Ave Ped Bridge | P06 of 82111 | | | 0 | - | - |
| | U-Turn Bridge (south on M-10) ?? Not in scope | | | | 0 | - | - |
| | Third Ave. | S30 of 82023 | | | 0 | - | - |
| | Second Ave. | S01 of 82024 | 270 | 89 | 24030 | $ 80.00 | $ 1,922,400.00 |
| | Cass | S02 of 82024 | 205 | 66 | 13530 | $ 80.00 | $ 1,082,400.00 |
| | Woodward | S03 of 82024 | 220 | 114 | 25080 | $ 80.00 | $ 2,006,400.00 |
| | John R | S04 of 82024 | | | 0 | - | - |
| | Brush | S05 of 82024 | 255 | 78 | 19890 | $ 80.00 | $ 1,591,200.00 |
| | Beaubien | S06 of 82024 | | | 0 | - | - |
| | Milwaukee St. over I-75 | S02 of 82252 | 240 | 64 | 15360 | $ 80.00 | $ 1,228,800.00 |
| | Abandoned RR Bridge | NOT NUMBERED | | | 0 | - | - |
| | Abandoned RR Bridge | NOT NUMBERED | | | 0 | - | - |
| | Piquette St. over I-75 | S01 of 82252 | | | 0 | - | - |
| | Ferry St. over I-75 | S20 of 82251 | | | 0 | - | - |
| | I75/I94 | S27 of 82251 | | | 0 | - | - |
| | I-75 SB to I-94 WB | S28 of 82251 | | | 0 | - | - |
| I-75 Interchange | I-94 WB to I-75 SB over I-94 | S24 of 82251 | | | 0 | - | - |
| | I-75 SB to I-94 EB over I-75 and I-94 | S30 of 82251 | | | 0 | - | - |
| | 94 W to 75S (West to South) over I-75 | S29 of 82251 | | | 0 | - | - |
| | 94E to 75N (East to North) | S26 of 82251 | | | 0 | - | - |
| | NBD I-75 to WBD I-94 | S25 of 82251 | | | 0 | - | - |
| | I-94 eB Ent ramp | S21 of 82251 | | | 0 | - | - |
| | I-94 EB to I-75 NB over I-75 | S23 of 82251 | | | 0 | - | - |
| | I-94 WB to I-75 SB over I-94E to I75 N | S22 of 82251 | | | 0 | - | - |
| | 94E to 75N (East to North) | | | | 71036 | $120.00 | $ 8,524,320.00 |
| | 75 to 94W (N.&S. to West) | | | | 47019 | $120.00 | $ 5,642,280.00 |
| | 94W to 75S (West to South) | | | | 81989 | $120.00 | $ 9,838,680.00 |
| | 75 to 94E (N.&S. to East) | | | | 48443 | $120.00 | $ 5,813,160.00 |
| | 75S to 94 (South) | | | | 12476 | $200.00 | $ 2,495,200.00 |
| | 75N to 94 (North) | | | | 18281 | $200.00 | $ 3,656,200.00 |
| | 94 over 75 (I-94) | | | | 48839 | $100.00 | $ 4,883,900.00 |
| | W Service over 75 (West Service) | | | | 8533 | $100.00 | $ 853,300.00 |
| | E Service over 75 (East Service) | | | | 13512 | $100.00 | $ 1,351,200.00 |
| | 1 Service over 94Eto75S (East Service) | | | | 2478 | $180.00 | $ 446,040.00 |
| | 2 Service over 94Eto75S (South Service) | | | | 3528 | $180.00 | $ 635,040.00 |
| | Service over 94Wto75N (North) | | | | 5011 | $180.00 | $ 901,980.00 |
| | Widen/Rebuild Dequindre (I-94) | | | | 102762 | $150.00 | $ 15,414,300.00 |
| | Misc I-75 Bridge Costs | | | | | | $ 4,215,000.00 |
| | Chene ramp to I-94 | S17 of 82024 | | | 0 | - | - |
| | Chene | S08 of 82024 | 190 | 78 | 14820 | $ 80.00 | $ 1,185,600.00 |
| | E. Grand | S09 of 82024 | 200 | 94 | 18800 | $ 80.00 | $ 1,504,000.00 |
| | Lucky Place | S18 of 82024 | | | 0 | - | - |
| | Saginaw U Turn | S19 of 82024 | | | 0 | - | - |
| | M. Elliott | S10 of 82024 | 190 | 204 | 38760 | $ 80.00 | $ 3,100,800.00 |
| | Harper EB | S16 of 82024 | | | 0 | - | - |
| | Conrail RR | X02 of 82024 | 310 | 50 | 15500 | $ 465.00 | $ 7,207,500.00 |
| | Concord | S11 of 82024 | 200 | 49 | 9800 | $ 80.00 | $ 784,000.00 |
| | Helen Ped | P04 of 82024 | | | 8880 | $ 80.00 | $ 710,400.00 |
| | Frontenac | S12 of 82024 | 200 | 54 | 10800 | $ 80.00 | $ 864,000.00 |
| | Townsend Ped | P05 of 82024 | | | 9120 | $ 80.00 | $ 729,600.00 |
| | Van Dyke | S13 of 82024 | 185 | 92 | 17020 | $ 80.00 | $ 1,361,600.00 |
| | Iroquois Ped | P06 of 82024 | | | 11800 | $ 80.00 | $ 944,000.00 |
| | Burns | S14 of 82024 | 200 | 54 | 10800 | $ 80.00 | $ 864,000.00 |
| | Rohns Ped | P07of 82024 | | | 11400 | $ 80.00 | $ 912,000.00 |
| | McClellan | S 15 of 82025 | | | 0 | - | - |
| | Gratiot | S01 of 82025 | 240 | 168 | 40320 | $ 80.00 | $ 3,225,600.00 |
| | Cadillac | S02 of 82025 | 200 | 56 | 11200 | $ 80.00 | $ 896,000.00 |
| | French | S03 of 82025 | 190 | 54 | 10260 | $ 80.00 | $ 820,800.00 |
| | Springfield Ped | P02 of 82025 | | | 9120 | $ 80.00 | $ 729,600.00 |
| | Conrail RR | X01 of 82025 | 335 | 55 | 18425 | $ 465.00 | $ 8,567,625.00 |
| | Conrail RR (Spur) | X01 of 82025 | | | | | |
| | Conner | | 150 | 173 | 25950 | $ 80.00 | $ 2,076,000.00 |
| | West Conner | S04 of 82025 | | | | | |
| | East Conner | S05 of 82025 | | | | | |
| | Malcolm Ped | P03 of 82025 | | | 5160 | $ 80.00 | $ 412,800.00 |
| | Barrett | S06 of 82025 | 150 | 54 | 8100 | $ 80.00 | $ 648,000.00 |

**Totals (As Proposed)** **$ 176,584,225.00**

**Totals (As Designed)** **$ 141,022,850.00**

**Difference** **$ 35,561,375.00**

| | | | | | | |
|---|---|---|---|---|---|---|
| GT Western Conrail (W) over I-94* | X02 of 82023 | 450 | 35 | 17250 | $ 465.00 | $ 8,021,250.00 |
| GT Western Conrail (E) over I-94* | X02 of 82023 | 460 | 40 | 20800 | $ 465.00 | $ 9,672,000.00 |

* Includes Cost of Railroad bridges removed and replaced over Kirby

$ 17,693,250.00

*Assumptions*
Removal Costs: Widths taken from aerial, lengths taken from Report 44 (Bridge Inventory Report)
Construction Costs: Widths taken from aerial, add 7' to each side for sidewalk in areas it applies.
Length of bridges taken from aerial and added 10' from edge of metal to face of full height abutment.

*Bridge Costs( per square foot):*
Construction

| | |
|---|---|
| Pedestrian bridge | $80.00 /SF |
| Local street bridges | $80.00 /SF |
| Mainline over mainline bridges | $100.00 /SF |
| Directional ramp bridges | $120.00 /SF |
| Dequindre widening | $150.00 /SF |
| Service drive bridges | $180.00 /SF |
| Braided ramp bridges** | $200.00 /SF |
| Railroad bridges | $465.00 /SF |

*Table 8.1*
*Bridge Construction Cost*
*VE Estimate*

| | Bridge Cost Validation | | Removal Length | Width | Area | Unit Cost | Total |
|---|---|---|---|---|---|---|---|
| | Grand River | S17 of 82023 | 251 | 100 | 25100 | $ 25.00 | $ 627,500.00 |
| | Linwood | S18 of 82023 | 173 | 62 | 10726 | $ 25.00 | $ 268,150.00 |
| | 14th Street | S19 of 82023 | 166 | 80 | 13280 | $ 25.00 | $ 332,000.00 |
| | GT Western Conrail (E) over Wabash* | NOT NUMBERED | 80 | 40 | 5600 | $ 45.00 | $ 252,000.00 |
| | Rosa Parks | S20 of 82023 | 120 | 50 | 6000 | $ 25.00 | $ 150,000.00 |
| | Trumbull | S21 of 82023 | 210 | 88 | 18480 | $ 25.00 | $ 462,000.00 |
| | GTW/Conrail Bridge (N) over M-10 | X01 of 82112 | 155 | 24 | 3720 | $ 45.00 | $ 167,400.00 |
| | GTW/Conrail Bridge (S) over M-10 | X01 of 82112 | 142 | 40 | 5680 | $ 45.00 | $ 255,600.00 |
| | Holden Ped Bridge | P01 of 82112 | 289 | 12 | 3468 | $ 15.00 | $ 52,020.00 |
| | Brooklyn St. Ped Bridge | P05 of 82023 | 347 | 12 | 4164 | $ 15.00 | $ 62,460.00 |
| M-10 Interchange | I-94 WB to M-10 SB (West to South) | S26 of 82023 | 1158 | 45 | 52110 | $ 25.00 | $ 1,302,750.00 |
| | M-10 SB over M-10 NB to I-94 WB | S22 of 82023 | 232 | 60 | 13920 | $ 25.00 | $ 348,000.00 |
| | M-10 NB (Mainline) | S27 of 82023 | 297 | 50 | 14850 | $ 25.00 | $ 371,250.00 |
| | M-10 SB (Mainline) | S24 of 82023 | 297 | 50 | 14850 | $ 25.00 | $ 371,250.00 |
| | M-10 NB over I-94 WB to M-10 SB | S29 of 82023 | 224 | 55 | 12320 | $ 25.00 | $ 308,000.00 |
| | I-94 EB to M-10 NB (East to North) | S25 of 82023 | 1134 | 45 | 51030 | $ 25.00 | $ 1,275,750.00 |
| | I-94 EB over I-94 EB to M-10 SB (East) | S23 of 82023 | 186 | 55 | 10230 | $ 25.00 | $ 255,750.00 |
| | I-94 WB over M-10 SB to I-94 EB | S28 of 82023 | 196 | 55 | 10780 | $ 25.00 | $ 269,500.00 |
| | I-94 EB SD to M-10 SB SD (East to South) | | | | | | |
| | I-94 EB SD to M-10 NB SD (East to North) | | | | | | |
| | I-94 WB SD to M-10 SB SD (West to South) | | | | | | |
| | I-94 WB SD to M-10 NB SD (West to North) | | | | | | |
| | M-10 NB to I-94 WB (North to West) | | | | | | |
| | M-10 NB to I-94 EB (North to East) | | | | | | |
| | M-10 SB to I-94 EB (South to East) | | | | | | |
| | M-10 SB to I-94 WB (South to West) | | | | | | |
| | M-10 NB (Mainline) | | | | | | |
| | M-10 SB (Mainline) | | | | | | |
| | M-10 NB SD (North Service) | | | | | | |
| | M-10 SB SD (South Service) | | | | | | |
| | Merrick Ave Ped Brridge | P07 of 82111 | 318 | 14 | 4452 | $ 15.00 | $ 66,780.00 |
| | Warren Ave Bridge | S19 of 82111 | 127 | 140 | 17780 | $ 25.00 | $ 444,500.00 |
| | Forest Ave Bridge | S18 of 82111 | 111 | 103 | 11433 | $ 25.00 | $ 285,825.00 |
| | Canfield Ave Ped Bridge | P06 of 82111 | 148 | 14 | 2072 | $ 15.00 | $ 31,080.00 |
| | U-Turn Bridge (south on M-10) ?? Not in scope | | | | | | |
| | Third Ave. | S30 of 82023 | 421 | 70 | 29470 | $ 25.00 | $ 736,750.00 |
| | Second Ave. | S01 of 82024 | 214 | 80 | 17120 | $ 25.00 | $ 428,000.00 |
| | Cass | S02 of 82024 | 190 | 80 | 15200 | $ 25.00 | $ 380,000.00 |
| | Woodward | S03 of 82024 | 237 | 125 | 29625 | $ 25.00 | $ 740,625.00 |
| | John R | S04 of 82024 | 172 | 60 | 10320 | $ 25.00 | $ 258,000.00 |
| | Brush | S05 of 82024 | 171 | 50 | 8550 | $ 25.00 | $ 213,750.00 |
| | Beaubien | S06 of 82024 | 174 | 60 | 10440 | $ 25.00 | $ 261,000.00 |
| | Milwaukee St. over I-75 | S02 of 82252 | 237 | 65 | 15405 | $ 25.00 | $ 385,125.00 |
| | Abandoned RR Bridge | NOT NUMBERED | 215 | 80 | 17200 | $ 45.00 | $ 774,000.00 |
| | Abandoned RR Bridge | NOT NUMBERED | 215 | 35 | 7525 | $ 45.00 | $ 338,625.00 |
| | Piquette St. over I-75 | S01 of 82252 | 219 | 120 | 26280 | $ 25.00 | $ 657,000.00 |
| | Ferry St. over I-75 | S20 of 82251 | 240 | 60 | 14400 | $ 25.00 | $ 360,000.00 |
| I-75 Interchange | I75/I94 | S27 of 82251 | 188 | 130 | 24440 | $ 25.00 | $ 611,000.00 |
| | I-75 SB to I-94 WB | S28 of 82251 | 153 | 45 | 6885 | $ 25.00 | $ 172,125.00 |
| | I-94 WB to I-75 SB over I-94 | S24 of 82251 | 309 | 40 | 12360 | $ 25.00 | $ 309,000.00 |
| | I-75 SB to I-94 EB over I-75 and I-94 | S30 of 82251 | 827 | 34 | 28118 | $ 25.00 | $ 702,950.00 |
| | 94 W to 75S (West to South) over I-75 | S29 of 82251 | 186 | 35 | 6510 | $ 25.00 | $ 162,750.00 |
| | 94E to 75N (East to North) | S26 of 82251 | 585 | 35 | 20475 | $ 25.00 | $ 511,875.00 |
| | NBD I-75 to WBD I-94 | S25 of 82251 | 772 | 35 | 27020 | $ 25.00 | $ 675,500.00 |
| | I-94 eB Ent ramp | S21 of 82251 | 172 | 30 | 5160 | $ 25.00 | $ 129,000.00 |
| | I-94 EB to I-75 NB over I-75 | S23 of 82251 | 307 | 30 | 9210 | $ 25.00 | $ 230,250.00 |
| | I-94 WB to I-75 SB over I-94E to I75 N | S22 of 82251 | 165 | 45 | 7425 | $ 25.00 | $ 185,625.00 |
| | 94E to 75N (East to North) | | | | | | |
| | 75 to 94W (N.&S. to West) | | | | | | |
| | 94W to 75S (West to South) | | | | | | |
| | 75 to 94E (N.&S. to East) | | | | | | |
| | 75S to 94 (South) | | | | | | |
| | 75N to 94 (North) | | | | | | |
| | 94 over 75 (I-94) | | | | | | |
| | W Service over 75 (West Service) | | | | | | |
| | E Service over 75 (East Service) | | | | | | |
| | 1 Service over 94Eto75S (East Service) | | | | | | |
| | 2 Service over 94Eto75S (South Service) | | | | | | |
| | Service over 94Wto75N (North) | | | | | | |
| | Widen/Rebuild Dequindre (I-94) | | | | | | |
| | Misc I-75 Bridge Costs | | | | | | |
| | Chene ramp to I-94 | S17 of 82024 | 183 | 30 | 5490 | $ 25.00 | $ 137,250.00 |
| | Chene | S08 of 82024 | 170 | 65 | 11050 | $ 25.00 | $ 276,250.00 |
| | E. Grand | S09 of 82024 | 186 | 120 | 22320 | $ 25.00 | $ 558,000.00 |
| | Lucky Place | S18 of 82024 | 174 | 45 | 7830 | $ 25.00 | $ 195,750.00 |
| | Saginaw U Turn | S19 of 82024 | 161 | 60 | 9660 | $ 25.00 | $ 241,500.00 |
| | M. Elliott | S10 of 82024 | 169 | 70 | 11830 | $ 25.00 | $ 295,750.00 |
| | Harper EB | S16 of 82024 | 171 | 40 | 6840 | $ 25.00 | $ 171,000.00 |
| | Conrail RR | X02 of 82024 | 120 | 50 | 6000 | $ 45.00 | $ 270,000.00 |
| | Concord | S11 of 82024 | 168 | 65 | 10920 | $ 25.00 | $ 273,000.00 |
| | Helen Ped | P04 of 82024 | 171 | 12 | 2052 | $ 15.00 | $ 30,780.00 |
| | Frontenac | S12 of 82024 | 168 | 60 | 10080 | $ 25.00 | $ 252,000.00 |
| | Townsend Ped | P05 of 82024 | 194 | 10 | 1940 | $ 15.00 | $ 29,100.00 |
| | Van Dyke | S13 of 82024 | 167 | 100 | 16700 | $ 25.00 | $ 417,500.00 |
| | Iroquois Ped | P06 of 82024 | 218 | 10 | 2180 | $ 15.00 | $ 32,700.00 |
| | Burns | S14 of 82024 | 167 | 65 | 10855 | $ 25.00 | $ 271,375.00 |
| | Rohns Ped | P07of 82024 | 159 | 12 | 1908 | $ 15.00 | $ 28,620.00 |
| | McClellan | S 15 of 82025 | 224 | 55 | 12320 | $ 25.00 | $ 308,000.00 |
| | Gratiot | S01 of 82025 | 284 | 120 | 34080 | $ 25.00 | $ 852,000.00 |
| | Cadillac | S02 of 82025 | 185 | 70 | 12950 | $ 25.00 | $ 323,750.00 |
| | French | S03 of 82025 | 171 | 60 | 10260 | $ 25.00 | $ 256,500.00 |
| | Springfield Ped | P02 of 82025 | 197 | 10 | 1970 | $ 15.00 | $ 29,550.00 |
| | Conrail RR | X01 of 82025 | 127 | 50 | 6350 | $ 45.00 | $ 285,750.00 |
| | Conrail RR (Spur) | X01 of 82025 | 125 | 25 | 3125 | $ 45.00 | $ 140,625.00 |
| | Conner | | | | | | $ - |
| | West Conner | S04 of 82025 | 220 | 60 | 13200 | $ 25.00 | $ 330,000.00 |
| | East Conner | S05 of 82025 | 171 | 60 | 10260 | $ 25.00 | $ 256,500.00 |
| | Malcolm Ped | P03 of 82025 | 217 | 12 | 2604 | $ 15.00 | $ 39,060.00 |
| | Barrett | S06 of 82025 | 171 | 70 | 11970 | $ 25.00 | $ 299,250.00 |

**Totals (VE Estimate)** **$ 23,784,075.00**

**Totals (DEIS Estimate)** **$ 19,876,000.00**

**Difference** **$ 3,908,075.00**

| | | | | | | |
|---|---|---|---|---|---|---|
| GT Western Conrail (W) over I-94* | X02 of 82023 | 174 | 70 | 13680 | $ 45.00 | $ 615,600.00 |
| GT Western Conrail (E) over I-94* | X02 of 82023 | 174 | 40 | 9360 | $ 45.00 | $ 421,200.00 |

* Includes Cost of Railroad bridges removed and replaced over Kirby

$ 1,036,800.00

*Assumptions*
Removal Costs: Widths taken from aerial, lengths taken from Report 44 (Bridge Inventory Report)
Construction Costs: Widths taken from aerial, add 7' to each side for sidewalk in areas it applies.
Length of bridges taken from aerial and added 10' from edge of metal to face of full height abutment.

*Bridge Costs( per square foot):*

| Removal | | |
|---|---|---|
| | Pedestrian bridge | $15.00 /SF |
| | Highway or local street bridge | $25.00 /SF |
| | Railroad bridge | $45.00 /SF |

*Table 8.2*
*Bridge Demolition Cost*
*VE Estimate*

***Retaining Walls (Refer to Proposal #1)***

*Base Cost:*
The total cost of the retaining walls, as shown on DEIS estimate, is $20,587,000 (Appendix A, Item #9). The cost is based on 40,969 linear feet with an average height of 8.38 ft. and using a unit price of $60.00/sf.

*Allowance:*
The VE team, based on the use of aerials and contour mapping estimated the total length of the wall to be 40,250 linear feet and an average height of 15 ft. Utilizing the same unit price of $60.00/sf. the total cost of the wall will be $41,625,000. In the absence of exact quantities the difference ($41,625,000 - $20,587,000) $21,038,000 is added to the allowance, which includes $10.2 million for reconstruction of 4,300 lf. of M-10 south of the M-10/I-94 interchange.

*Contingency:*
- Accounts for the difference between a VE study cost estimate that assumes a 15-ft.-high wall with a unit cost of $60/sft. and a VE study cost estimate that assumes a 15-ft.-high wall with a unit cost of $100/sft. The VE team assumes that $100/sft. is an appropriate cost estimate for a 15-ft.-high wall.

- Contingency is calculated as ($69,375,000 - $41,625,000) $27,750,000.

*Reserve:*
- Accounts for the difference between a VE study cost estimate that assumes a 15-ft.-high wall with a unit cost of $100/sft. and a VE study cost estimate that assumes a 20-ft.-high wall with a unit cost of $100/sft. A 20-ft.-high wall represents an increased wall height that would result if sloped mainline embankment proposed in the DEIS is replaced with retaining walls.

- Reserve is calculated as ($92,500,000 - $69,375,000) $23,125,000.

**Pavement**

Pavement includes; asphalt pavement, concrete pavement and three inch mill and overlay.

*Allowance:*
- Accounts for the difference between the DEIS and the validated study cost estimate. The validation detail for mainline and ramps follows. Using the same unit price of $90/sy. the difference between the DEIS and the VE estimate is $1,826,000 as shown on Exhibit 8.3. An additional $17.0 million has been added for concrete pavement for the reconstruction of 4,300 lf. of M-10/I-94 interchange not included in the DEIS estimate.

- An additional allowance is assumed to be 10% of the total base pavement cost. This accounts for all miscellaneous pavement-related cost elements, i.e., underdrains, joints, slope restoration, and the $0.3 million difference between the DEIS and VE estimate for ashpalt pavement on crossroads and service drives as shown on Exhibit 8.4.

0.1($3,900,000+$69,300,000+$616,000) = $7,382,000

| | |
|---|---|
| Difference in Quantity = | $ 1,826,000 |
| M-10 Pavement | $17,000,000 |
| Miscellaneous Related Items | $ 7,382,000 |
| | $26,208,000 |

*Contingency:*
- Accounts for unknown field conditions and staging requirements. This includes subgrade and earthwork costs, temporary roadway, and temporary sheeting.

- Contingency is assumed to be 15% of the total base pavement cost.
0.15($3,900,000+$69,300,000+$616,000)= $11,072,000

*Reserve:*
- Accounts for changes in the pavement concept, i.e., a change in the proposed typical sections, additional lanes or extended limits on crossroads.

- Reserve is assumed to be 5% of the total base pavement cost.
0.05($3,900,000+$69,300,000+$616,000)= $3,691,000

**CONCRETE PAVEMENT (12/12 SECTION)**

Areas taken from polygons on level 49 of the Mod 1 drawings
Areas include median and all shoulders
Ramps included in polygons along I-94 from POB to I-75 only

| **I-94 mainline** | Quant. | Unit |
|---|---|---|
| POB to 2nd St | 1,442,632 | SF |
| 2nd St to I-75 | 893,795 | SF |
| I-75 to St. Aubin | 2,263,936 | SF |
| St Aubin to Gratiot | 710,155 | SF |
| Graiot to POE | 310,076 | SF |
| **M-10** | | |
| POE to I-94 | 533,808 | SF |
| I-94 to POB | 491,226 | SF |
| **I-75 & M-10 Inerchange** | | |
| SB I-75 off ramp | 23,425 | SF |
| SB I-75 to I-94 EB & WB | 26,622 | SF |
| EB I-94 to SB I-75 | 69,302 | SF |
| WB I-94 to I-75 SB | 44,973 | SF |
| NB I-75 off ramp | 38,713 | SF |
| NB I-75 to I-94 EB & WB | 23,428 | SF |
| SB I-75 to SB CD road | 13,037 | SF |
| WB I-94 to I-75 NB | 24,167 | SF |
| EB I-94 to NB I-75 | 21,465 | SF |
| **Subtotal** | 6,930,760 | SF |
| **Total (VE Estimate)** | **7,113,420** | **SF** |
| **Total (DEIS Estimate)** | **6,930,841** | **SF** |
| **VE Cost Estimate** | **790380** | **@$90/SY=** |
| **DEIS Cost Estimate** | **770093** | **@$90/SY=** |
| **Difference =** | | |

**Ramps I-75 to POE**

| **Location** | Quant. | Unit |
|---|---|---|
| I-94 WB to Conner | 19,803 | SF |
| Conner to I-94 WB | 10,036 | SF |
| I-94 WB to Gratiot | 7,418 | SF |
| Gratiot to I-94 WB | 7,831 | SF |
| I-94 WB to Van Dyke | 10,073 | SF |
| Van Dyke to I-94 WB | 9,116 | SF |
| I-94 WB to Mt. Elliot | 8,590 | SF |
| Mt. Elliot to I-94 WB | 8,597 | SF |
| I-94 WB to Chene | 10,687 | SF |
| Chene to I-94 WB | 3,575 | SF |
| I-94 EB to Chene | 7,634 | SF |
| Chene to I-94 EB | 5,502 | SF |
| I-94 EB to Mt. Elliot | 6,326 | SF |
| Mt. Elliot to I-94 EB | 8,620 | SF |
| I-94 EB to Van Dyke | 9,003 | SF |
| Van Dyke to I-94 EB | 10,073 | SF |
| I-94 EB to Gratiot | 3,943 | SF |
| Gratiot to I-94 EB | 7,419 | SF |
| I-94 EB to Conner | 8,820 | SF |
| Conner to I-94 EB | 19,594 | SF |
| | 182,660 | SF |
| | **790,380** | **SY** |
| | **770,093** | **SY** |
| | $71,134,200 | |
| | $69,308,410 | |
| | $1,825,790 | |

*Exhibit 8.3*

**ASPHALT PAVEMENT (6/12 SECTION)**

Areas taken from level 50 of the Mod 1 drawings
Areas include median and all shoulders
Ramps included along I-94 from I-75 to POE

**WB Service Drive**

| | Qunat. | Unit |
|---|---|---|
| POE to Trumbul | 157,580 | SF |
| Trumbul to M-10 | 110,739 | SF |
| M-10 to I-75 | 300,692 | SF |
| I-75 to St. Aubin | 81,756 | SF |
| St. Aubin to Chene | 135,636 | SF |
| Chene to E. Grand | 180,945 | SF |
| E. Grand to Mt. Elliot | 87,484 | SF |
| Mt. Elliot approach | 23,484 | SF |
| Mt. Elliot to Van Dyke | 183,952 | SF |
| Van Dyke to French | 267,145 | SF |
| French to Conner | 84,926 | SF |
| Conner Approach | 150,827 | SF |

**EB Service Drive**

| | | |
|---|---|---|
| POE to Trumbul | 124,636 | SF |
| Trumbul approach | 13,394 | SF |
| Trumbul to 2nd St | 78,137 | SF |
| 2nd to I-75 | 158,309 | SF |
| I-75 to Russel | 68,670 | SF |
| Russel to Gratiot | 589,526 | SF |
| Mt. Elliot approach | 17,113 | SF |
| Gratiot approach | 49,493 | SF |
| Gratiot to POE | 340,578 | includes conner approach |
| approaches to Conner | 6,423 | SF |

**M-10 Service Drive**

| | | |
|---|---|---|
| NB | 42,899 | SF |
| SB | 67,500 | SF |
| SB Ramp | 8,285 | SF |

**I-75 Service Drive**

| | | |
|---|---|---|
| North of I-94 | 122,516 | SF |
| NB | 68,671 | SF |
| SB | 46,921 | SF |
| Subtotal | 3,568,237 | SF |
| **Total (VE Estimate)** | **3,385,577** | **SF** |
| **Total (DEIS Estimate)** | **3,614,508** | **SF** |
| **Difference=** | | |

**Ramps I-75 to POE**

| | Quant. | Unit |
|---|---|---|
| I-94 WB to Conner | 19,803 | SF |
| Conner to I-94 WB | 10,036 | SF |
| I-94 WB to Gratiot | 7,418 | SF |
| Gratiot to I-94 WB | 7,831 | SF |
| I-94 WB to Van Dyke | 10,073 | SF |
| Van Dyke to I-94 WB | 9,116 | SF |
| I-94 WB to Mt. Elliot | 8,590 | SF |
| Mt. Elliot to I-94 WB | 8,597 | SF |
| I-94 WB to Chene | 10,687 | SF |
| Chene to I-94 WB | 3,575 | SF |
| I-94 EB to Chene | 7,634 | SF |
| Chene to I-94 EB | 5,502 | SF |
| I-94 EB to Mt. Elliot | 6,326 | SF |
| Mt. Elliot to I-94 EB | 8,620 | SF |
| I-94 EB to Van Dyke | 9,003 | SF |
| Van Dyke to I-94 EB | 10,073 | SF |
| I-94 EB to Gratiot | 3,943 | SF |
| Gratiot to I-94 EB | 7,419 | SF |
| I-94 EB to Conner | 8,820 | SF |
| Conner to I-94 EB | 19,594 | SF |
| | 182,660 | SF |

**376,175 SY**
**401,612 SY**
Note: DEIS Estimate includes Asphalt and Mill and Overlay quantities

**Difference=** **25,437** SY X $11.70/SY = $297,610

*Exhibit 8.4*

### Enhancement

*Allowance*
- Allowance is assumed to be 4% of the total base cost.
  0.04($334,934,000) = $13,397,000

*Contingency*
- Contingency is assumed to be 0% of the total base cost.
  = $0

*Reserve*
- Reserve is assumed to be 2% of the total base cost.
  0.02($334,934,000) = $6,699,000

### Right-of-Way (ROW)

*Allowance:*
- Allowance is assumed to be $35 million.

*Contingency:*
- Contingency is assumed to be $15 million.

*Reserve:*
- Reserve is assumed to be $0 million.

### Mobilization

*Allowance:*
A factor of 5% of Base Cost ($334,934,000) plus the following allowances were used:

| | |
|---|---|
| Utility Relocation | $10,690,000 |
| Traffic Control | $19,170,000 |
| Drainage | $3,000,000 |
| Bridges | $35,561,000 |
| Removal of Structures | $3,908,000 |
| Retaining Walls | $21,038,000 |
| Pavement | $26,208,000 |
| Enhancement | $13,397,000 |
| | $132,972,000 |

.05 x ($334,934,000 + $132,972,000) = $23,395,000

*Contingency:*
A factor of 1% of the following contingencies were used.

| | |
|---|---|
| Utility Relocation | $10,690,000 |
| Traffic Control | $10,790,000 |
| Drainage | $7,400,000 |
| Bridges | $25,329,000 |
| Removal of Structures | $0 |
| Retaining Walls | $27,750,000 |
| Pavement | $11,072,000 |
| Enhancement | $ 0 |
| | $93,031,000 |

.01 x $93,031,000 = $930,000

Reserve:
- Reserve is assumed to be 0%. $0

### Engineering Fee

Allowance:
A factor of 25% of Base Cost ($334,934,000) plus the following allowances were used:

| | |
|---|---|
| Utility Relocation | $10,690,000 |
| Traffic Control | $19,170,000 |
| Drainage | $3,000,000 |
| Bridges | $35,561,000 |
| Removal of Structures | $3,908,000 |
| Retaining Walls | $21,038,000 |
| Pavement | $26,208,000 |
| Enhancement | $13,397,000 |
| | $132,150,000 |

.25 x ($334,934,000 + $132,972,000) = $116,977,000

*Contingency:*
A factor of 25% of the following contingencies were used.

| | |
|---|---|
| Utility Relocation | $10,690,000 |
| Traffic Control | $10,790,000 |
| Drainage | $7,400,000 |
| Bridges | $25,329,000 |
| Removal of Structures | $0 |
| Retaining Walls | $27,750,000 |
| Pavement | $11,072,000 |
| Enhancement | $ 0 |
| | $ 93,031,000 |

.25 x $93,031,000 = $23,258,000

*Reserve*
A factor of 25% of the following reserves were used.

| | |
|---|---|
| Utility Relocation | $0 |
| Traffic Control | $50,000,000 |
| Drainage | $40,600,000 |
| Bridges | $37,722,000 |
| Removal of Structures | $1,037,000 |
| Retaining Walls | $23,125,000 |
| Pavement | $3,691,000 |
| Enhancement | $ 6,699,000 |
| | $162,874,000 |

.25 x $162,874,000 = $40,719,000